D-SLD-EN **Sept 2011**

SolDrag

Solar-powered dragster

TECHNOLOGIE AU COLLEGE

www.a4.fr

SolDrag

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CDROM CONTENTS

This project's CDRom is available in the A4 Company catalog (ref "CD-SLD).
It contains :
- the FreeHand version folder,
- the Illustrator version folder,
- the PDF version folder,
- product's photos, synthesis pictures, .DXF format perspectives,
- machining files,
- the full 3D product **modeling in its various** versions with **3D** files SolidWorks, Parasolid and eDrawings format.

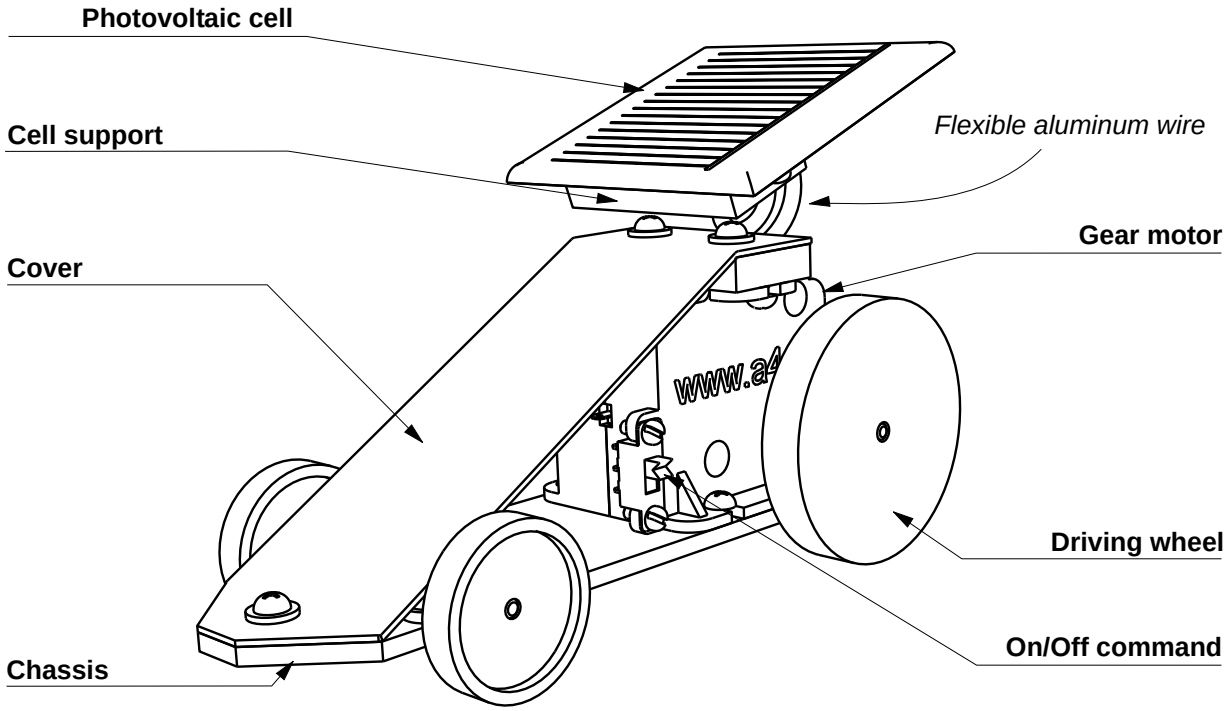
Product presentation

Functioning

Electric vehicle powered by solar energy.
Only operates in direct sunlight (unless the super capacity option capacitor) or an incandescent lamp. Under tungsten or halogen lighting, A minimum of 300 W at 20 cm from the photovoltaic cell is required for an equivalent efficiency. A fluorescent tube lighting (neon type) don't allow the photovoltaic cell to power the motor.
The photovoltaic cell mounted on a flexible wire is rotable to better capture the light.
In option, a 10 F super capacity capacitor can be mounted to store energy allowing a few minutes operation without direct lighting.

Manufacturing

- Chassis : made of expanded PVC 3 x 40 x 127 mm (provided to dimensions in the kit) : angles cutting + screws pointing
- Photovoltaic cell support : made of 6 x 20 x 40 mm expanded PVC: cutting + drilling.
- Cover : made of PS choc 1 x 40 x 127 mm (provided at dimensions in the kit) : angles cutting + drilling.
- Cell support aluminum wire to be formatted
- Angles to be cut again + small diameters drilling + hot bending on thermo-bender with resistant wire or cold bending.
- PropulsO gear motor : provided in injected spare parts to be assembled.
- Ø 3 steel axles : to be cut again with ends chamfered.
- Wiring : wires to be soldered for photovoltaic cell, motor and switch connecting.



Kit

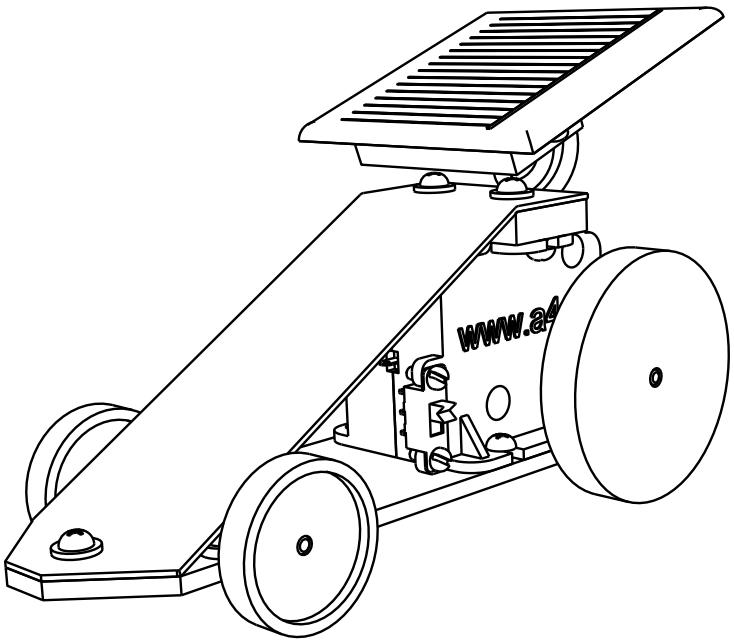
All parts and materials are available at retail. The K-SLD-01 reference kit contains the plastic parts delivered at dimensions and also all parts and components (see on page 16).

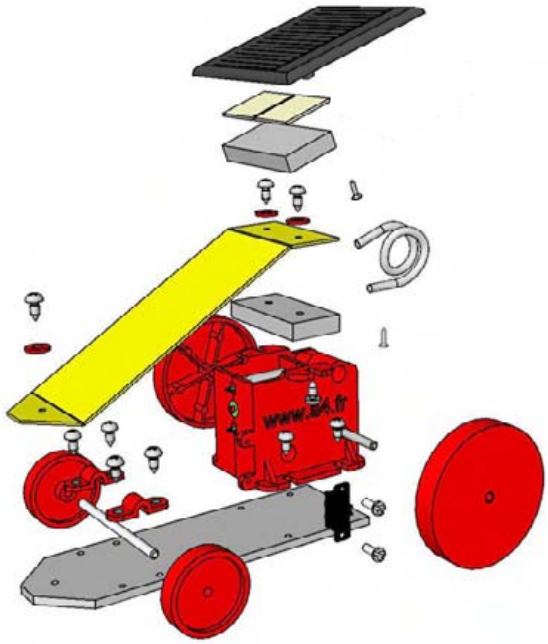
Soldrag vehicle photovoltaic cell

A cell converts lighting energy into electric energy. It exist several technologies for photovoltaic cells

Technology	Efficiency	Cost	Utilization
Monocristallin cell	24%	High	Aerospace
Polycristallin cell	18,6%	Medium	Home
Amorphous cell	12,7%	Low	Common products

The SolDrag photovoltaic cell is amorphous type : it has the cost advantage but has a good efficiency only in a limited wave length range, in the near infrared.





A	01	Motor group	See detailed nomenclature of this assembly on page 04
25	01	Wiring wires (not shown)	Red flexible wire, 1 conductor , length 125 mm
24	01	Wiring wires (not shown)	Fil souple rouge, 1 conducteur , length 15 mm
23	01	Wiring wires (not shown)	Black flaxible wire, 1 conductor , length 140 mm
22	01	Switch	Sliuder unipolar micro-inverter
20	01	Photovoltaic cell	3 x 60 x 60 mm, 100 mAh under sunlight
19	02	Double-sided tape	Double-sided tape 20 x 20 mm
18	13	Screw CH Ø 3 x 6,5	Nickel-plated steel, metal sheet, cylindric head, Ø 3 x L 6,5 mm
17	02	Screw MH Ø 2,2 x 4,5	Nickel-plated steel, metal sheet, milled head, Ø 2,2 x L 4,5 mm
16	02	Screw TC Ø 2 x 6	Nickel-plated steel, metal sheet, cylindric head, Ø 2 x L 6 mm
11	02	Rear wheel	Injected ABS (on PropulsO set), Ø 48 mm
10	02	Front wheel	Injected ABS (on PropulsO set), Ø 28 mm
09	02	Staples	Injected ABS (on PropulsO set)
08	03	Washers 3 x 9	Injected ABS (on PropulsO set)
07	01	Aluminum wire	Aluminum wire Ø 3 x L 110 mm
05	01	Front wheels axle	Nickel-plated steel, Ø 3 x L 55 mm
04	01	Photovoltaic cell support plate	Expanded PVC, thickness 6 x 20 x 40 mm
03	01	Spacer plate	Expanded PVC, thickness 6 x 20 x 40 mm
02	01	Cover	PS Choc, thickness 1 x 40 x 127 mm
01	01	Chassis	Expanded PVC, thickness 3 x 40 x 127 mm
MARK	**NUMBER**	**DESIGNATION**	**CHARACTERISTICS**

A4 TECHNOLOGY AT SCHOOL

School *Class*

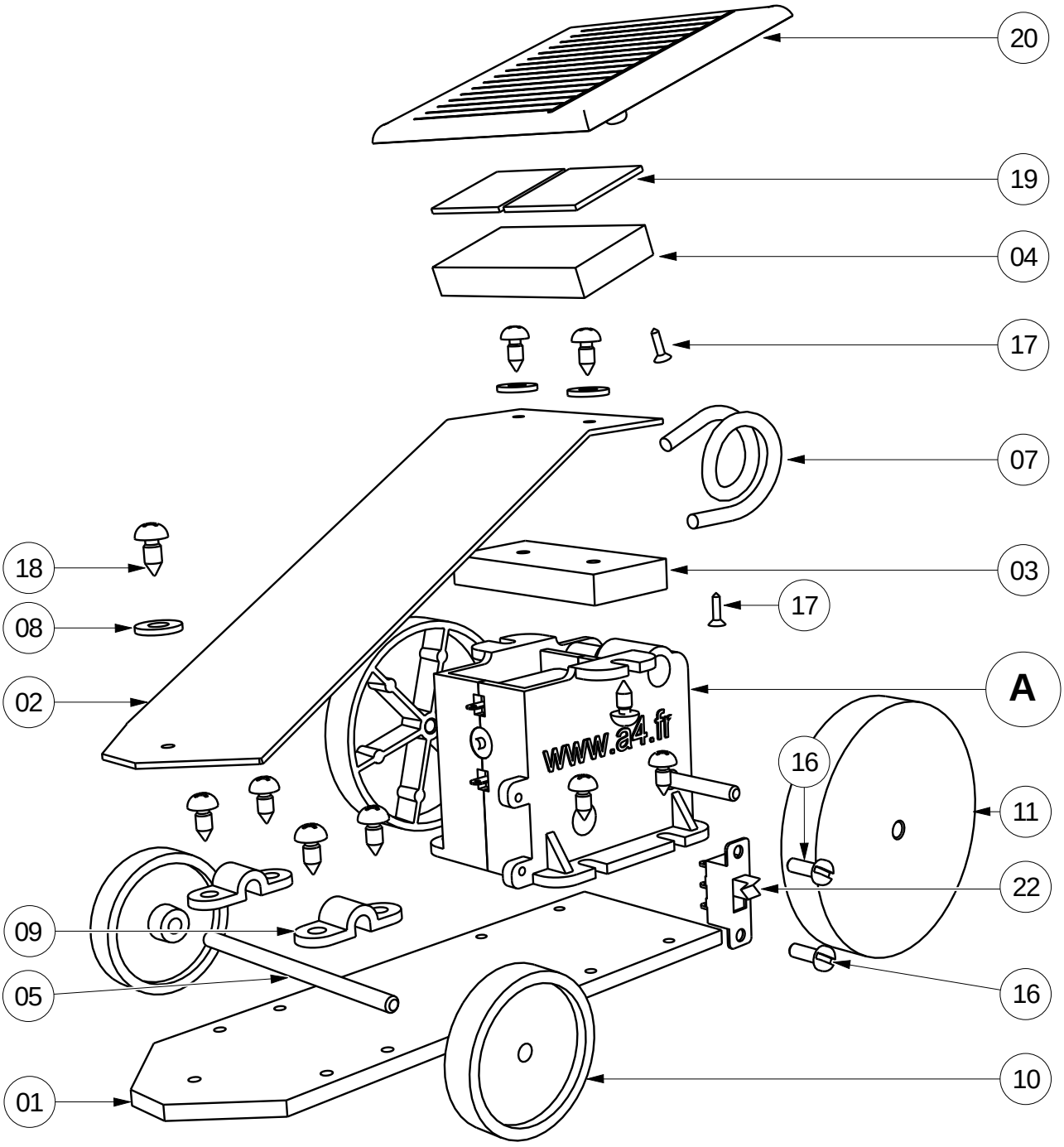
Name *Date*

PROJECT SolDrag

PART **Assembly**

DOCUMENT TITLE **NOMENCLATURE**

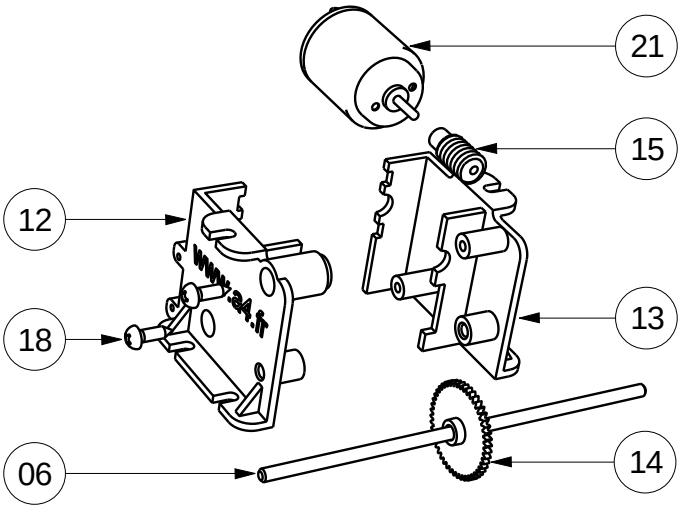
Exercice
Color moving elements



Not marked screws are (18)

TECHNOLOGY AT SCHOOL	A4	PROJECT SolDrag	PART Assembly
School / Class		DOCUMENT TITLE EXPLODED VIEW	
Name / Date			

Motor group exploded view (Mark A)
PropulsO gear mortor equipped with a motor especially adapted to the photovoltaic cell used.

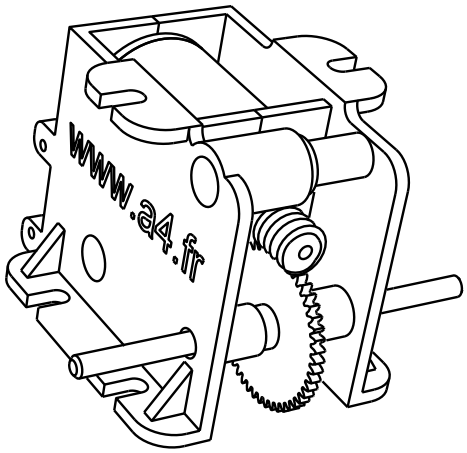


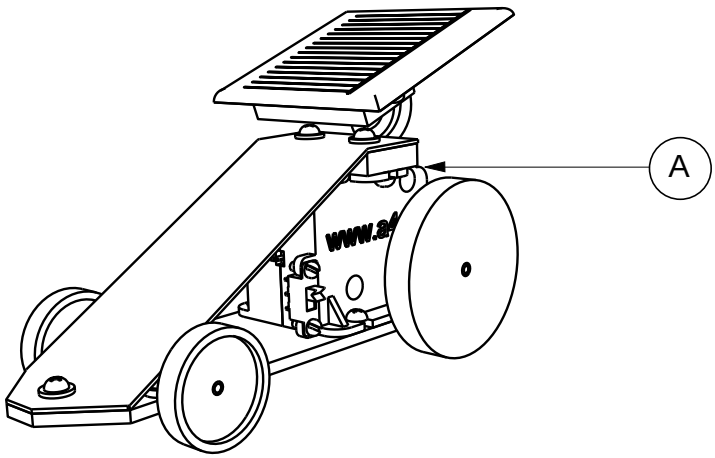
Important tips for the gear motor operation :

The axle musn't be distorded. That can happen especially when it's cut with a saw and badly held in a vice.

Don't forget to chamfer the axle ends (see on page 09). The fitting of a non-chamfered axle at ends destroys the pinion hub removing a chip during the process. The pinion risk then to be unbalanced and free of rotation on its axle.

An oil drop on the endless screw can improve the gear operation.





MARK	NUMBER	DESIGNATION	CHARACTERISTICS
21	01	Motor	Ø 21 - Output axle Ø 2 - 2300 tr/min under 1.5 V.
18	02	Screw CH Ø 3 x 6,5	Nickel-plated steel, metal sheet, cylindric head, Ø 3 x L 6.5 mm
15	01	Endless screw	Injected ABS (on PropulsO set)
14	01	Gear	Injected ABS (on PropulsO set), 48 teeth
13	01	Left flank	Injected ABS (on PropulsO set)
12	01	Right flank	Injected ABS (on PropulsO set)
06	01	Rear driving wheels axle	Nickel-plated steel, Ø 3 x L 60 mm

TECHNOLOGY AT SCHOOL

A4

School Class

Name Date

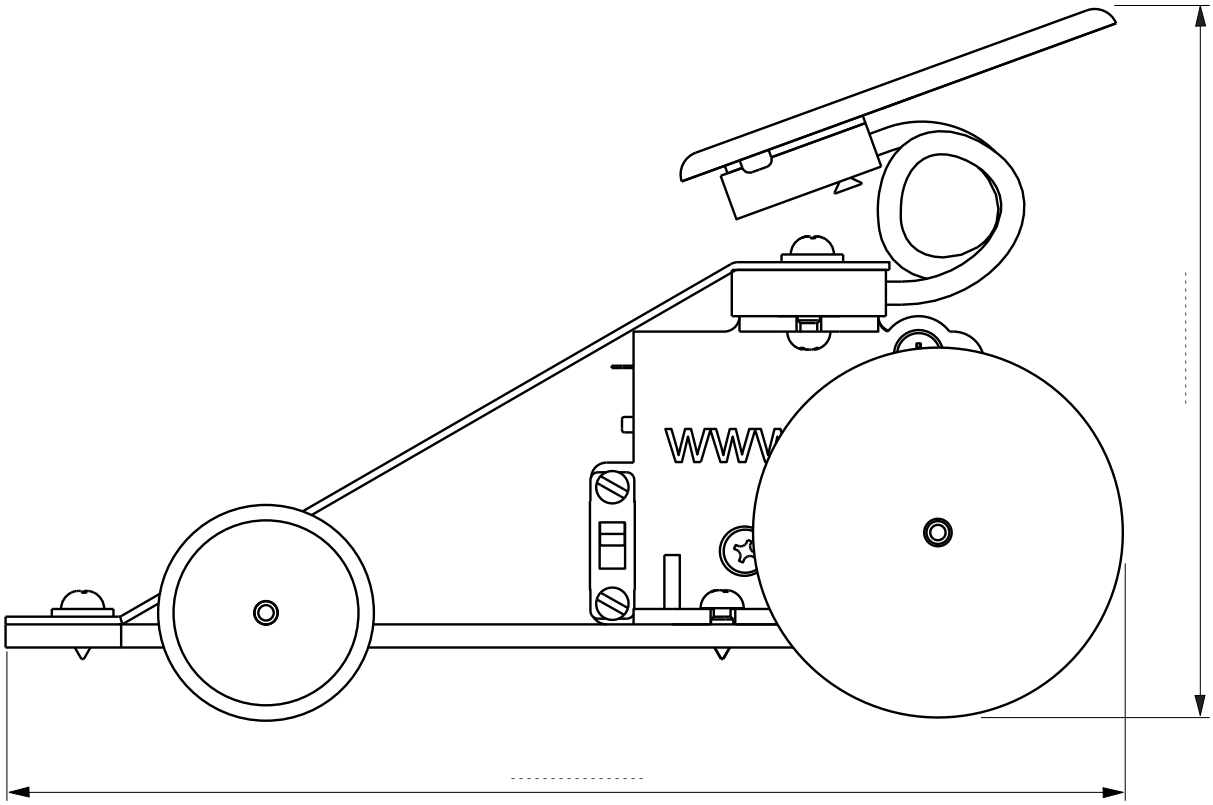
PROJECT SolDrag

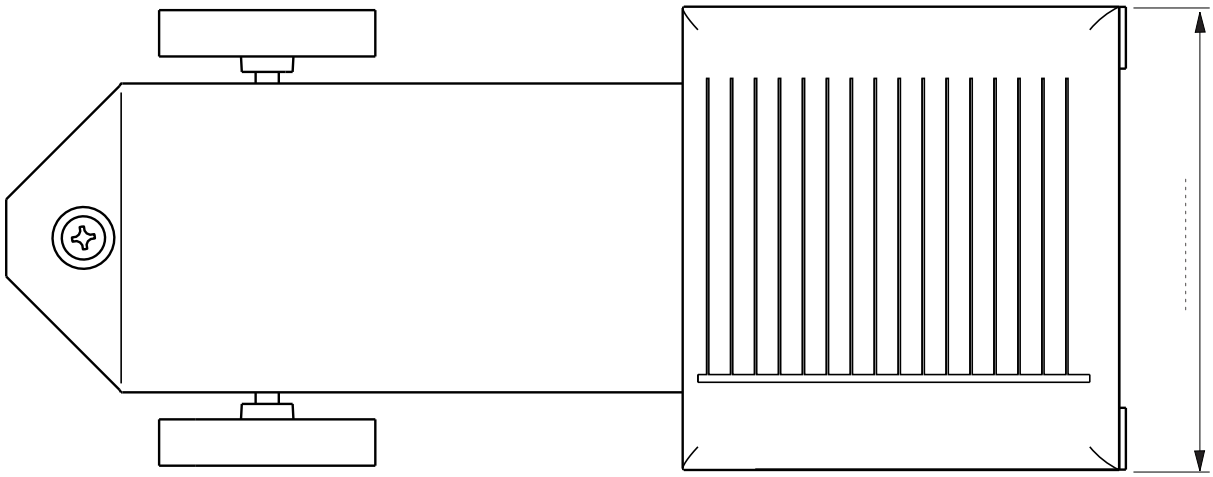
PART **Motor group**

DOCUMENT TITLE **EXPLODED VIEW and NOMENCLATURE**

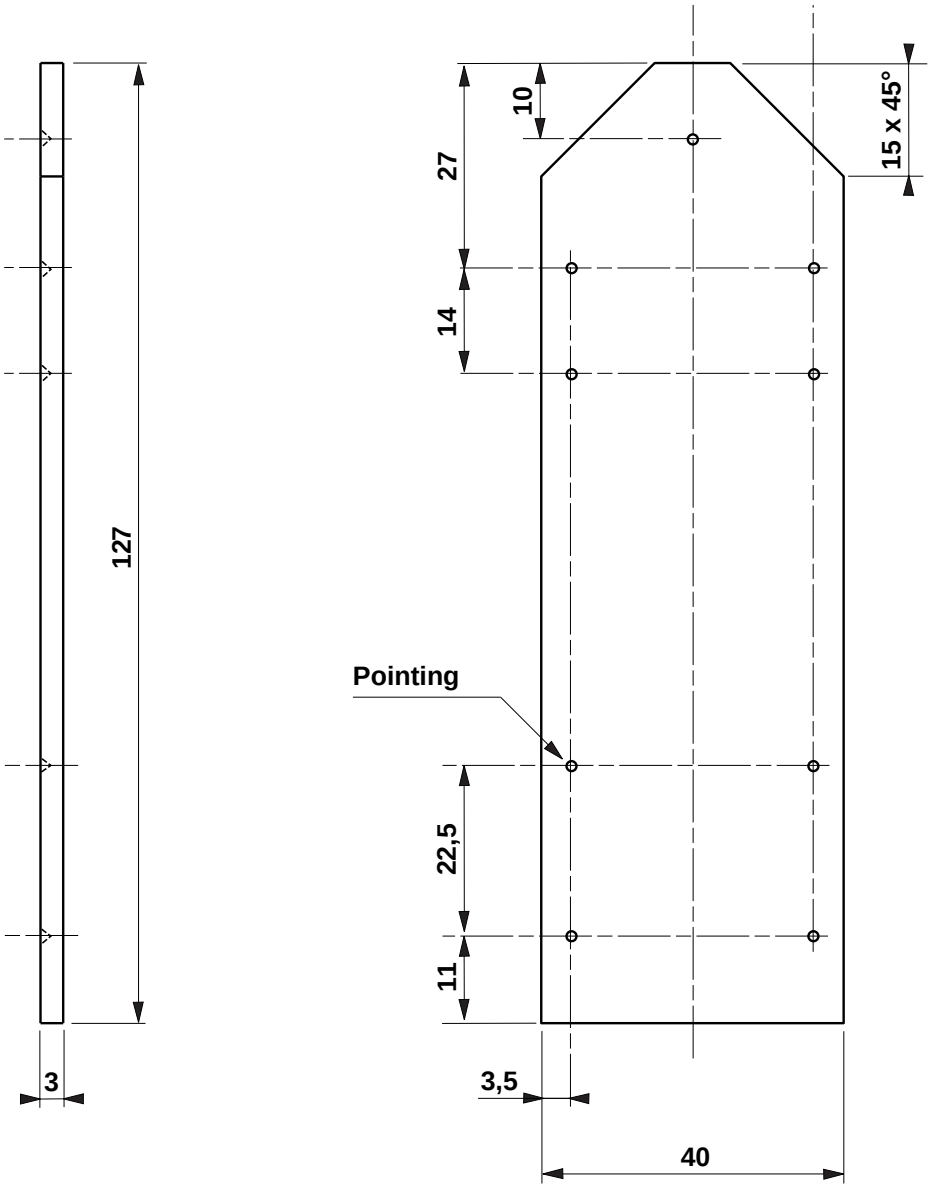
Exercise

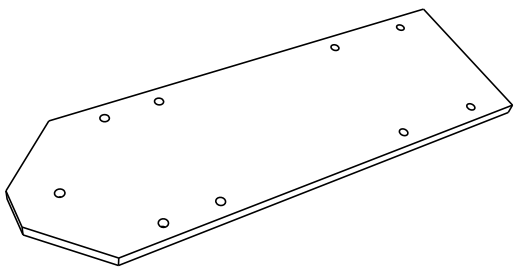
Note three space dimensions and write them on the drawing with a pencil.





TECHNOLOGY AT SCHOOL	Scale 1 : 1 — A4	PROJECT: SolDrag	PART: **Assembly**
	School / Class	DOCUMENT TITLE: **2 VIEWS DRAWING**	
	Name / Date		





Pointings are used to position and engage screws.
They are made with a needle or a 1.5 mm diameter drill.

MARK	NUMBER	DESIGNATION	CHARACTERISTICS
01	01	Chassis	Expanded PVC, thickness 3 x 40 x 127 mm

TECHNOLOGY AT SCHOOL

Scale 1 : 1 | A4

School | Class

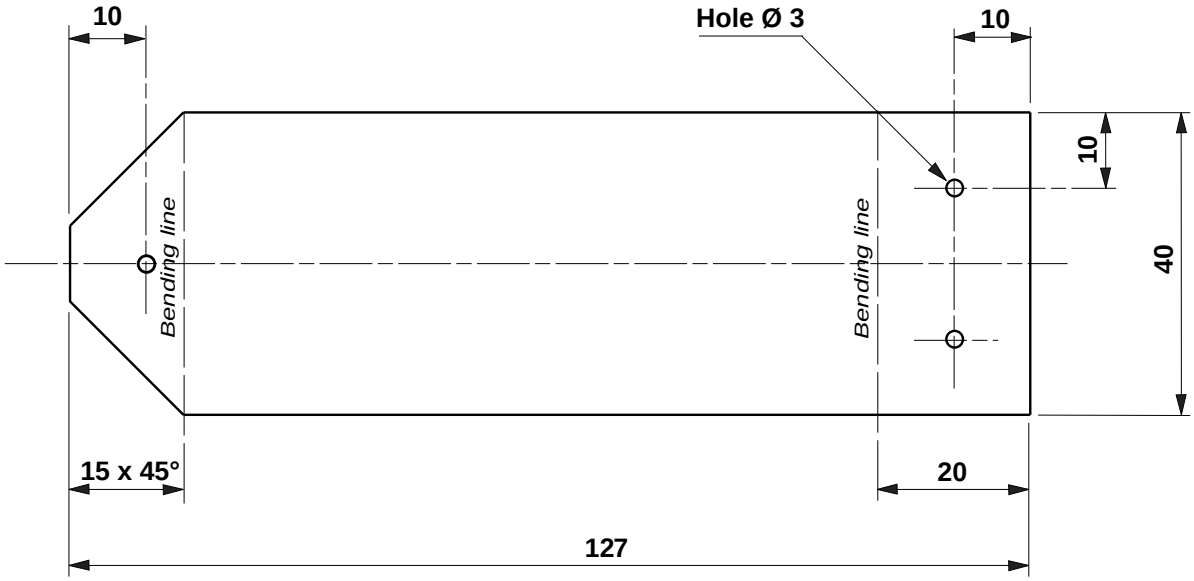
Name | Date

PROJECT: SolDrag

PART: **Chassis**

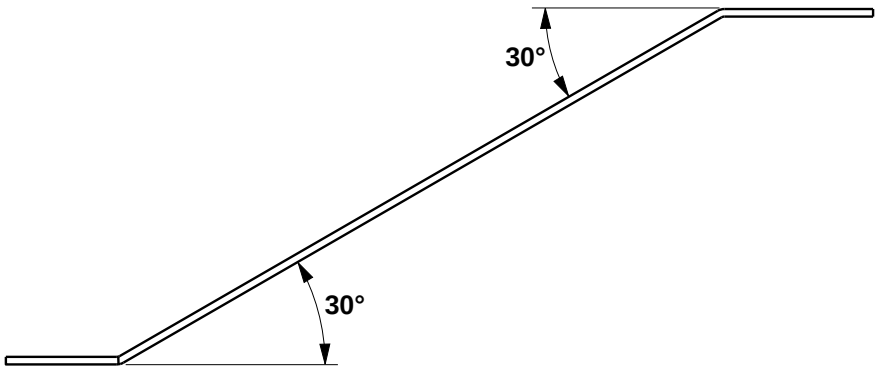
DOCUMENT TITLE: **DEFINITION DRAWING**

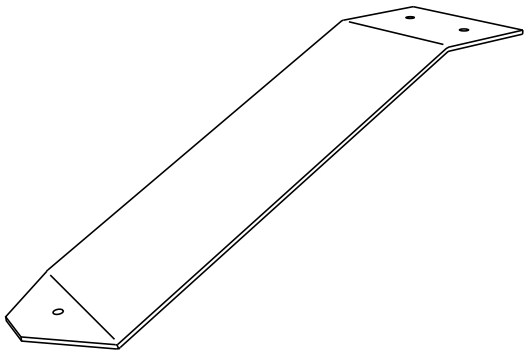
Cutting and drilling drawing (before bending)



The three holes are 3 mm diameter and open.

Bending drawing





Hot bending on thermo-bender with resistant wire or cold bending after grooving.

02	01	Cover	PS Choc, thickness 1 x 40 x 127 mm
MARK	NUMBER	DESIGNATION	CHARACTERISTICS

TECHNOLOGY AT SCHOOL

Scale 1 : 1 | A4

School | Class

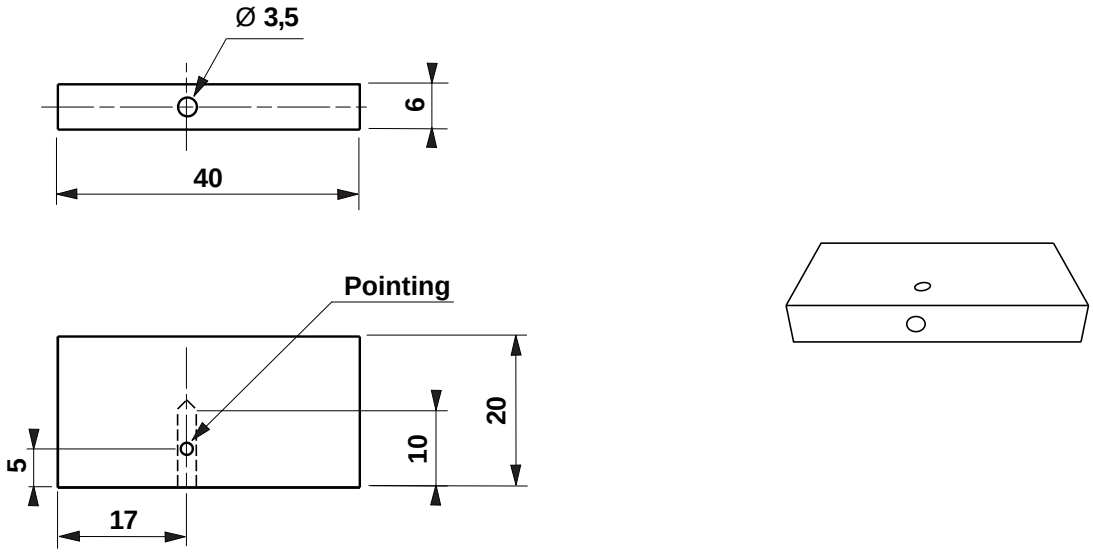
Name | Date

PROJECT: SolDrag

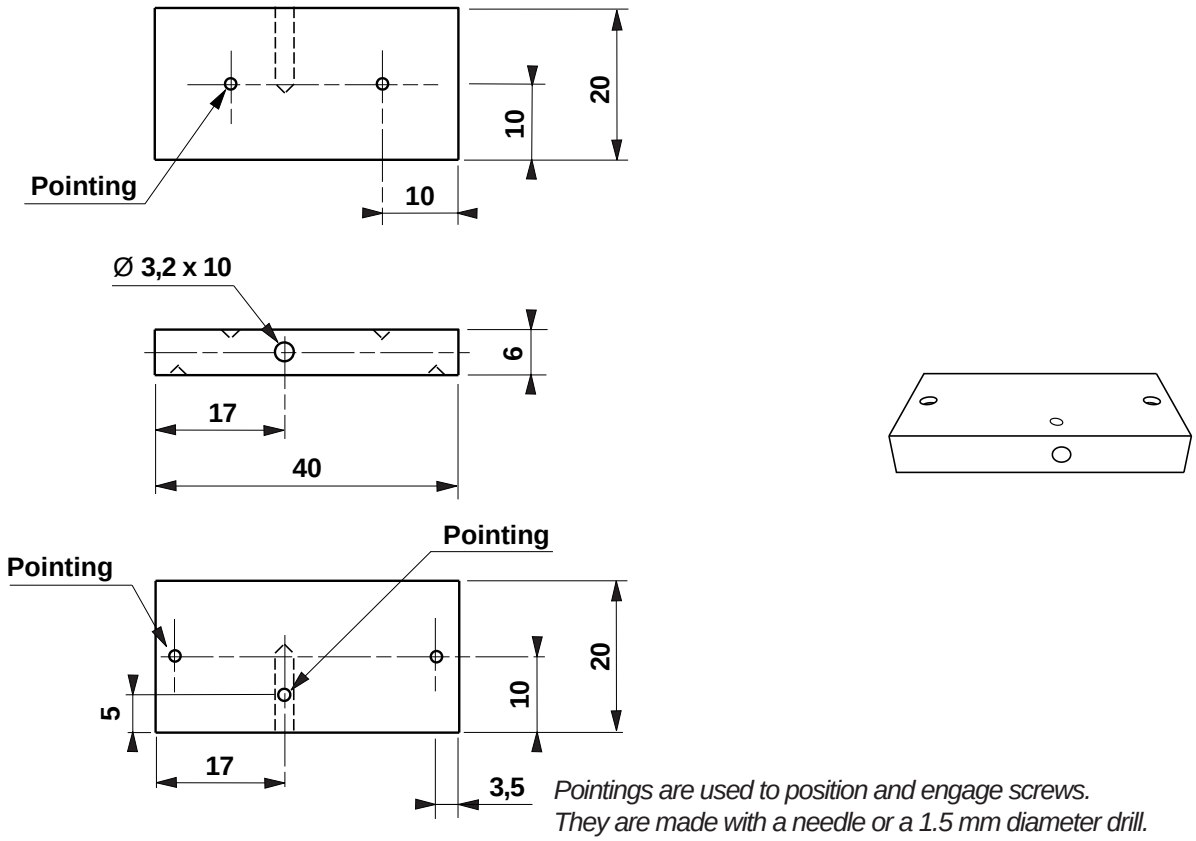
PART: **Cover**

DOCUMENT TITLE: **DEFINITION DRAWING**

Cell support plate (Mark 04)



Spacer plate (Mark 03)



Pointings are used to position and engage screws.
They are made with a needle or a 1.5 mm diameter drill.

MARK	NUMBER	DESIGNATION	CHARACTERISTICS
04	01	Photovoltaic cell support plate	Expanded PVC, thickness 6 x 20 x 40 mm
03	01	Spacer plate	Expanded PVC, thickness 6 x 20 x 40 mm

TECHNOLOGY AT SCHOOL

Echelle 1 : 1 | A4

School | Class

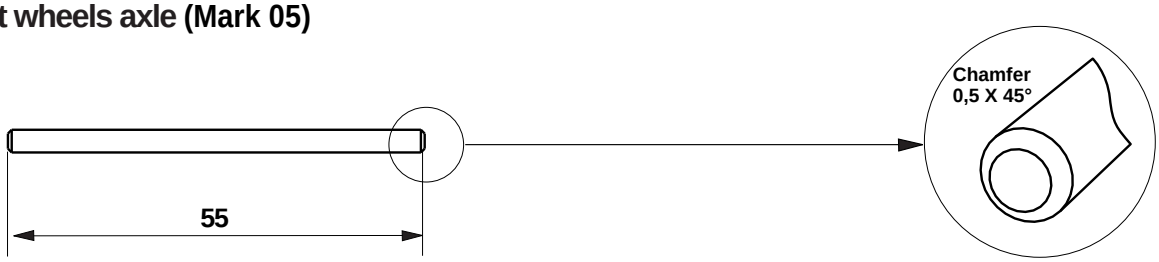
Name | Date

PROJECT: SolDrag

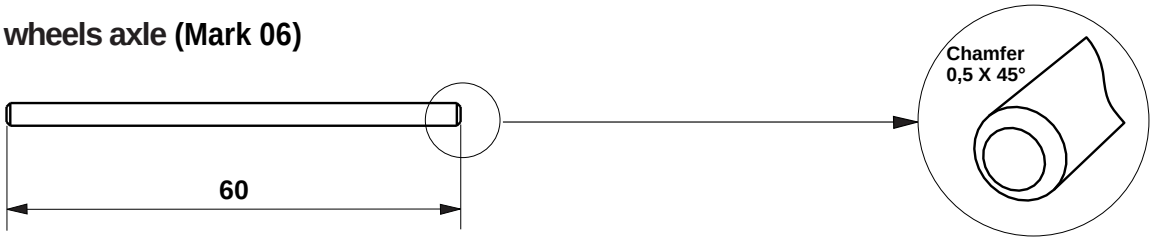
PART: **Cell support plates and spacer**

DOCUMENT TITLE: **DESSIN DE DEFINITION**

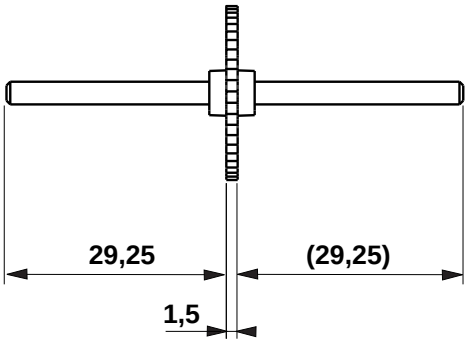
Front wheels axle (Mark 05)

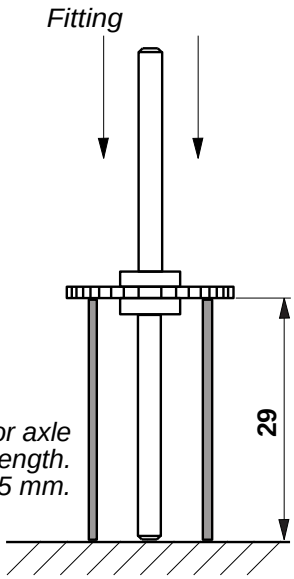


Rear wheels axle (Mark 06)

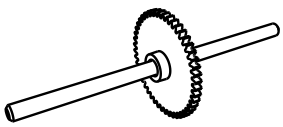


Rear wheels axle assembly (6) with the gear (14)





We will use as template for axle fitting a tube cut at 29 mm length. The functional tolerance is 1.5 mm.



MARK	NUMBER	DESIGNATION	CHARACTERISTICS
14	01	Gear	Injected ABS (on PropulsO set), 48 teeth
06	01	Rear driving wheels axle	Nickel-plated steel, Ø 3 x L 60 mm
05	01	Front wheels axle	Nickel-plated steel, Ø 3 x L 55 mm

TECHNOLOGY AT SCHOOL

Scale 1 : 1 | A4

School | Class

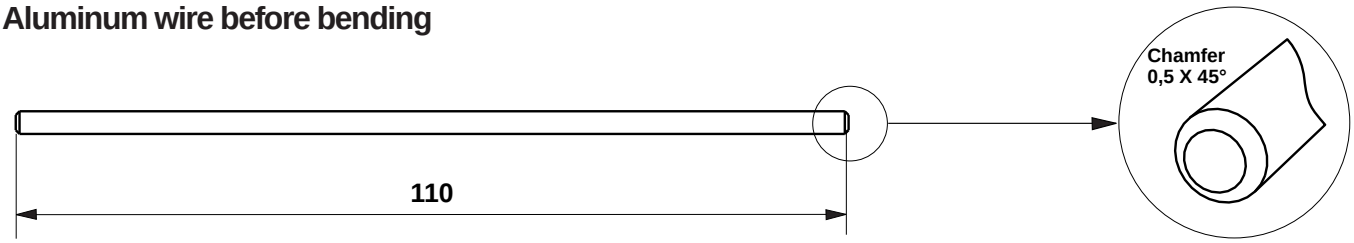
Name | Date

PROJECT: SolDrag

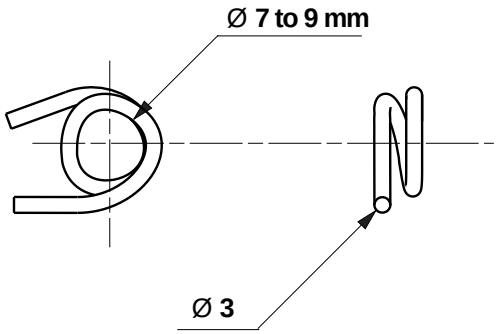
PART: **Wheels axles**

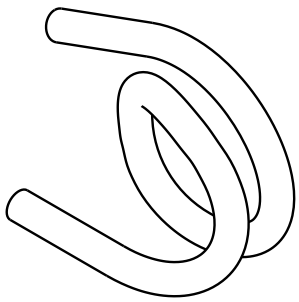
DOCUMENT TITLE: **DEFINITION DRAWING**

Aluminum wire before bending



Aluminum wire bended (Mark 07)





07	01	Aluminum wire	Alu wire Ø 3 x L 110 mm
MARK	NUMBER	DESIGNATION	CHARACTERISTICS

TECHNOLOGY AT SCHOOL

Scale 1 : 1 | A4

School | Class

Name | Date

PROJECT: SolDrag

PART: Aluminum wire

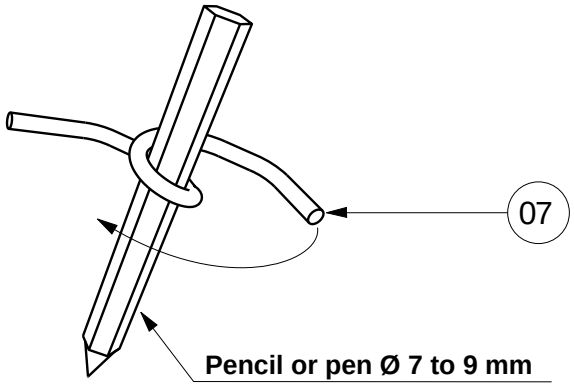
TITRE DU DOCUMENT: DEFINITION DRAWING

Aluminum wire formatting (07)

Important tips for formatting aluminum wire :

- a template is required to make easily the formatting, for example a pen or a pencil which diameter is between 7 and 9 mm,

- make a full turn with the aluminum wire arround the template

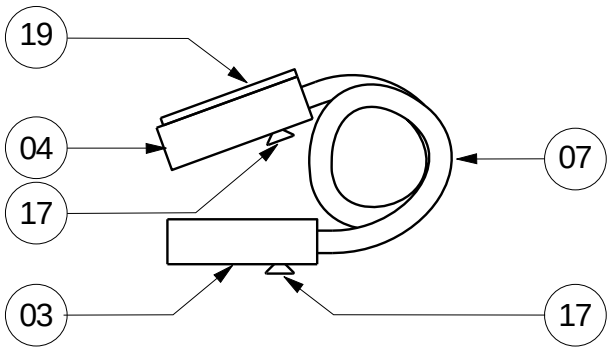


Plates and aluminum wire assembling

Important tips for mounting the aluminum wire on the various plates :

- The wire ends must be chamfered,

- screws (mark 17) are used to stop the aluminum wire (mark 07) in the plates (marks 03 and 04).



MARK	NUMBER	DESIGNATION	CHARACTERISTICS
19	02	Double-sided tape	20 x 20 mm double-sided tape
17	02	Screw MH Ø 2,2 x 4,5	NIclel-plated steel, metal sheet, milled head, Ø 2.2 x L 4,5 mm
07	01	Aluminum wire	Alu wire Ø 3 x L 110 mm
04	01	Photovoltaic cell support plate	Expanded PVC, thickness 6 x 20 x 40 mm
03	01	Spacer plate	Expanded PVC, thickness 6 x 20 x 40 mm

TECHNOLOGY AT SCHOOL

Scale 1 : 1 | A4

School | Class

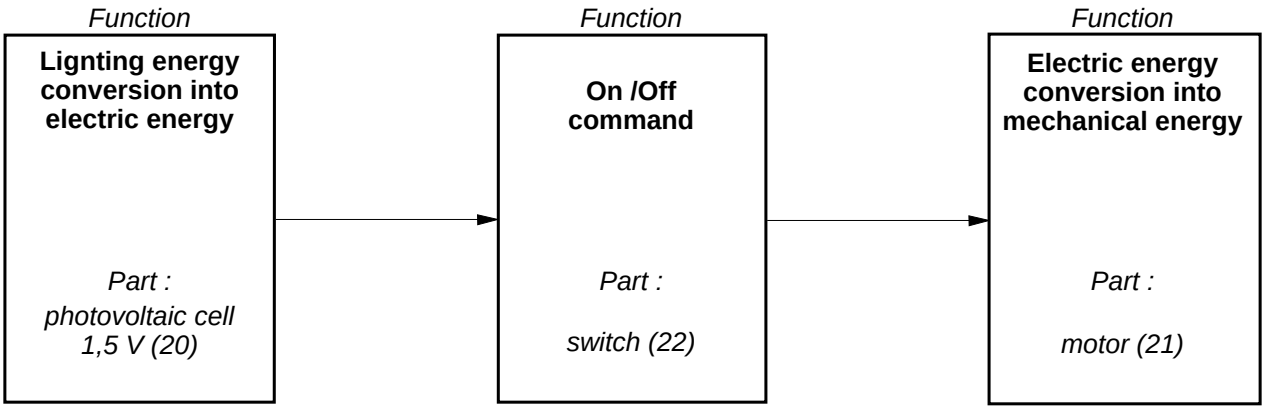
Name | Date

PROJECT: SolDrag

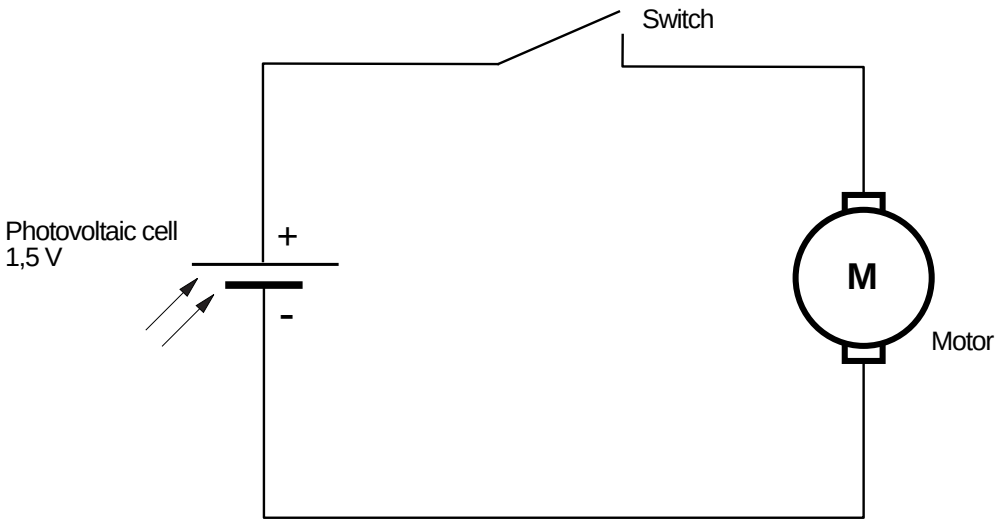
PART: **Aluminum wire**

DOCUMENT TITLE: **FORMATTING AND ASSEMBLY ORGANIGRAM**

Functional diagram



Structural diagram

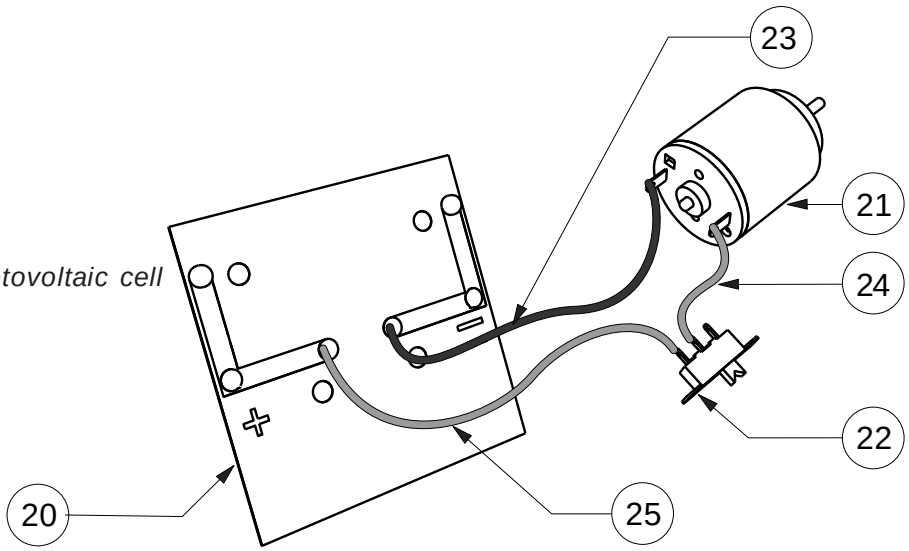


TECHNOLOGY AT SCHOOL	A4	PROJECT SolDrag	PART Electric circuit
School / Class		DOCUMENT TITLE	FUNCTIONAL SCHEME STRUCTURAL SCHEME
Name / Date			

Electrical elements wiring

- Photovoltaic cell (Mark 20)
- Motor (Mark 21)
- Switch (Mark 22)
- Black wire (Mark 23), length 140 mm
- Red wire (Mark 24), length 15 mm
- Red wire (Mark 25), length 125 mm

We use wires provides with the photovoltaic cell



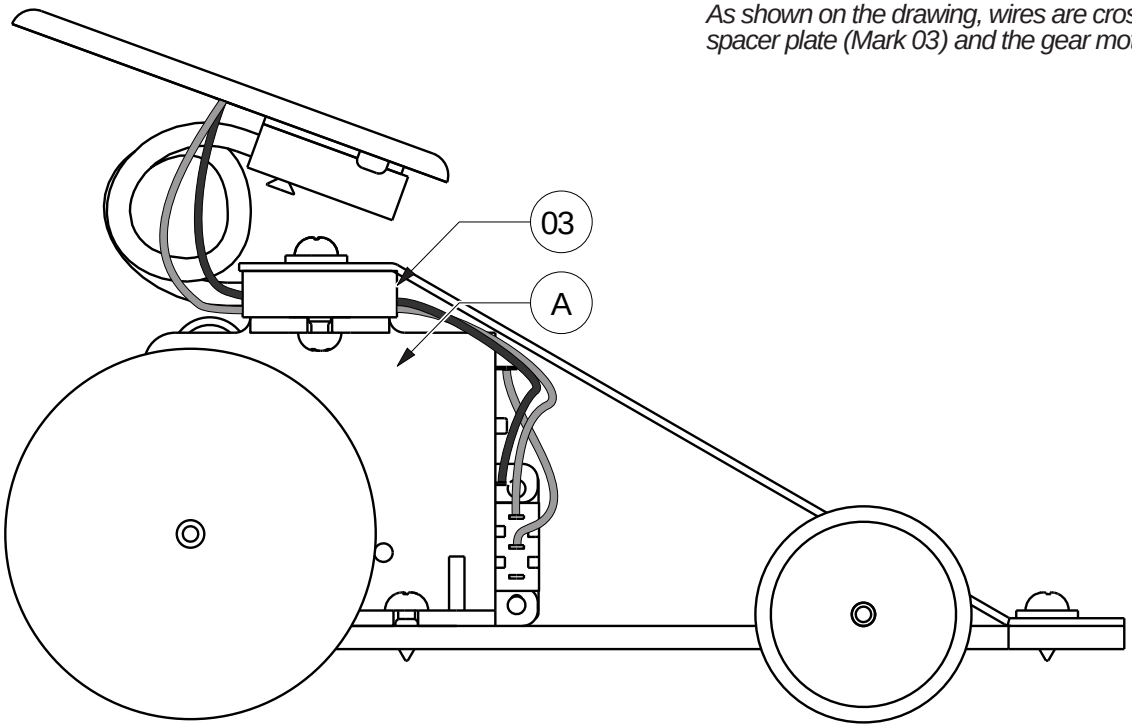
Motors polarity

The motors used are reversible; they can rotate in both directions.
One must determines by a test on the first of a serial on which motor terminal one must connect the + of the photovoltaic cell so that the vehicle moves in the good direction. In fact, from a serial to another one, marks on motor terminals can be different.

Test to be done on the first of a serial :
- Identify how one can distinguish between both motor terminals.
- Make an operation test to identify on which terminal one must connect the + of the photovoltaic cell for the whole serial to be manufactured.

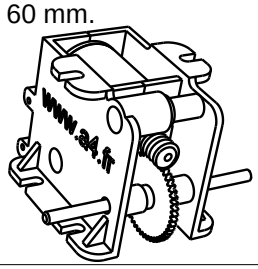
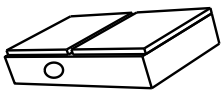
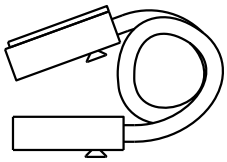
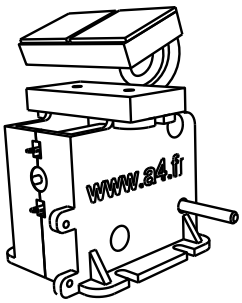
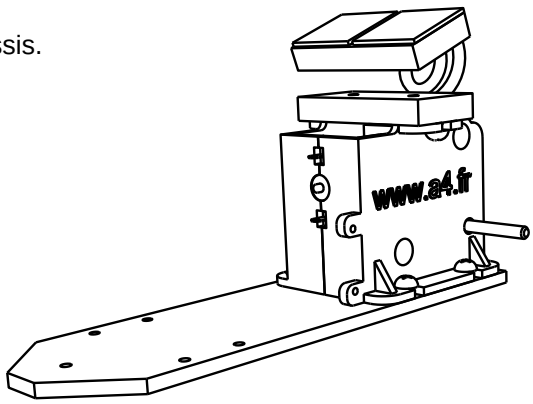
Wires passage on the vehicle

As shown on the drawing, wires are crossing between the spacer plate (Mark 03) and the gear motor (Mark A).

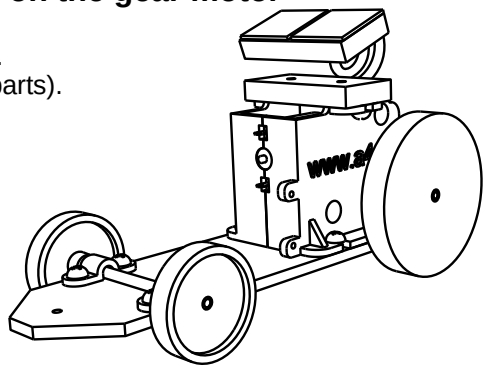
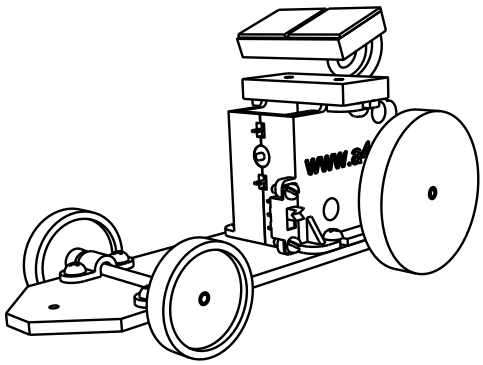
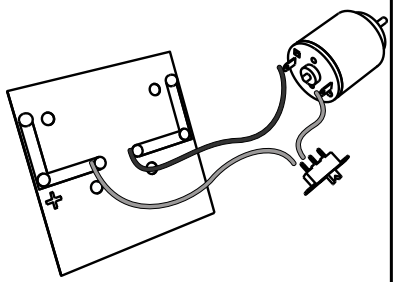
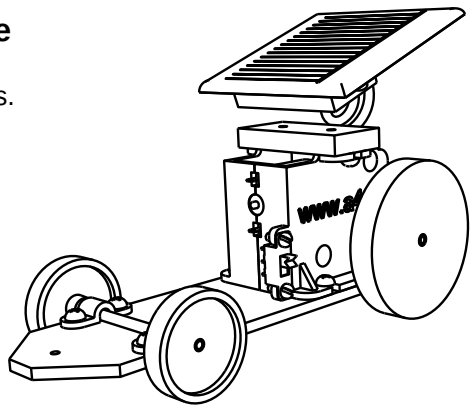
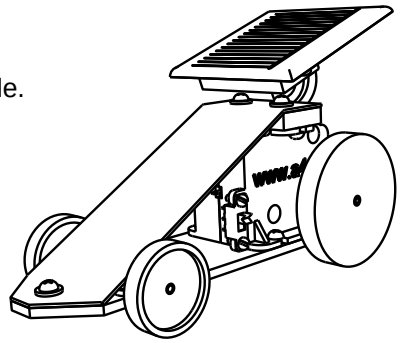


TECHNOLOGY AT SCHOOL	Scale 1 : 1 — A4	PROJECT: SolDrag	PART: **Electric circuit**
	School / Class	DOCUMENT TITLE: **WIRING ORGANIGRAM**	
	Name / Date		

MOUNTING SHEET - From K-SLD kit elements

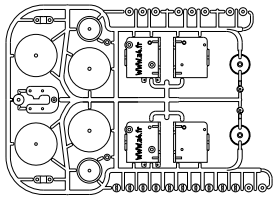
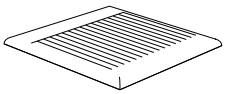
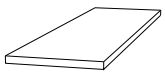
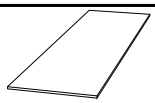
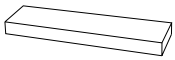
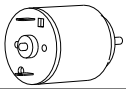
Phases	Operations
100	**Motor group assembly** Plan : gear motor assembly plan on page 04. Parts : PropulsO set, 2 screws TC Ø 3 x 6.5 mm, motor, steel axle Ø 3 x L 60 mm. Material : cruciform screwdriver, cutter plier. Control : functioning test with a power supply (battery) 1.5 to 3 V. 
120	**Setting double-sided tape pads on the cell support plate** Parts : cell support plate and double-sided adhesive pellets. Control : positioning ; the double-sides pellets musn't exceed the plate sides. 
130	**aluminum wire and plates assembly** Plan : assembly plan of alu wire and plates on page 11. Part : spacer plate, cell support plate, aluminum wire Ø 3 x L 110 mm, 2 screws MH Ø 2.2 x L 4.5 mm. Material : cruciform screwdriver. Control : one can bend the aluminum wire without it moves (rotation) in the plates. 
140	**Setting the spacer plate on the motor group** Parts : 2 screws TC Ø 3 x 6.5 mm, motor group, aluminum wire and asssembled plates Material : cruciform screwdriver. Control : good support : no gap in the assembly. 
150	**Setting the motor group on the chassis** Parts : groupe moteur, 4 vis TC Ø 3 x 6.5 mm, chassis. Material : cruciform screwdriver. Control : good support : no gap in the assembly. 

MOUNTING SHEET - From K-SLD kit elements

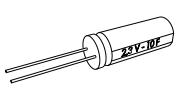
Phases	Operations
160	**Fixing the front axle on the chassis and rear wheels on the gear motor** Parts : 2 wheels Ø 28, 2 wheels Ø 48, 2 treads, 4 screws CH Ø 3 x 6.5 mm, chassis, axle Ø 3 x L 55. Material : cruciform screwdriver, cutter plier (removing plastic parts). Control : good support : no gap in the screwed assemblies but the front axle must stay free of rotation. 
170	**Fixing the switch on the motor group** Parts : groupe moteur, interrupteur, 2 vis Ø 2 x 6 mm. Material : cruciform screwdriver. Control : good support : no gap in the assembly. 
180	**Wiring** Plan : wiring diagram of various electrical elements on page 13. Parts : motor group, switch, connecting wires marks 23, 24 and 25. Material : soldering iron, cutter plier. Control : functioning test under sunlight or incandescent light. 
190	**Fixing the photovoltaic cdell on the cell support plate** Parts : cellule photovoltaïque, cell support plate equipped with 2 double-sided pellets. Control : good support : no gap in the assembly. 
200	**Fixing the cover on the chassis** Parts : 3 washers Ø 3x9, 3 screws CH Ø 3 x 6.5 mm, cover, vehicle. Material : cruciform screwdriver, cutter plier. Control : good support : no gap in the assembly. 

Ref K-SLD-01 kit nomenclature

The kit described here corresponds to the individual one (to make an object) :
The kit for 10 manufacturing differs by the quantity of each part (x 10) and the parts are grouped by type.
In the kits, plastic parts have good dimensions.
Important tips : not to loose parts, avoid to detach them from the PropulsO injection bunch before use.

Designation	Quantity	Drawing
Ref. : PO-GRAP-01-R	01	
Photovoltaic cell 4.5 V - 100 mAh under sunlight. Dimensions 60 x 60 x thickness 3 mm. Ref. : CEL-2V6-160MA	01	
Expanded PVC plate grey 127 x 40 x thickness 3 mm (chassis).	01	
PS Choc plate yellow 127 x 40 x thickness 1 mm (cover).	01	
Expanded PVC plate grey 20 x 90 (85 mini) x thickness 6 mm	01	
Double-sided adhesive pellet 20 x 20 mm. Ref AD-D08	02	
Steel axle Ø 3 x length120 mm minimum.	01	
Aluminum wire Ø 3 x length 110 mm minimum.	01	
Screw metal sheet type ; cylindric head Ø 2 x L 6.5. Ref. : VT-TC-2X6	02	
Screw metal sheet type ; cylindric head Ø 3 x L 6.5. Ref. : VT-TC-3X6	15	
Screw metal sheet type ; milled head Ø 2.2 x L 4.5. Ref. : VIS-TF-2M2X4M5	02	
Special electric motor adapted to the solar cell. 2300 tr/min under 1.5 V - Ø 21 - Axle 2 mm. Ref MOT-D21-SOL-A	01	
Micro-inverter with slider. Ref INV-GLI	01	

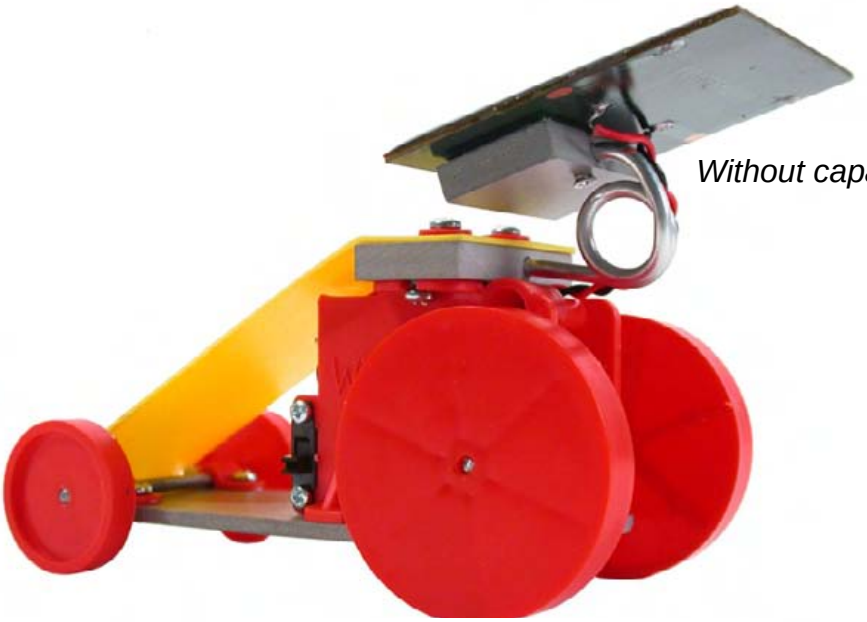
Electric energy storage capacitor option

Super capacity chemical capacitor 2.3 V - 10 F. Ref : CDC-10F	01	

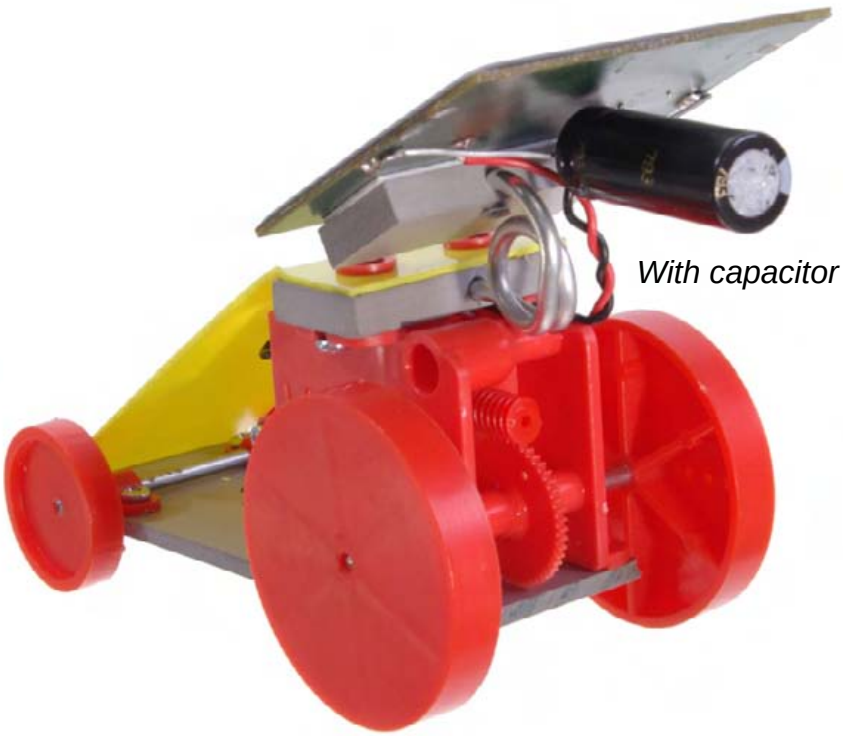
Electric energy storage capacitor option

The super capacity capacitor is directly soldered to photovoltaic cell terminals.
As soon as the cell is lighted, even under a diffuse light, the capacitor is loading.
At starting the vehicle, the capacitor is unloading in the motor, that ensure an autonomy up to 8 minutes according to its loads.

Remark :
To simplify, there is no serial diode with the capacitor. Consequently, during a lack of lighting, the capacitor is unloading through the photovoltaic cell.
Then, to operates the vehicle, a previous light exposition is required.

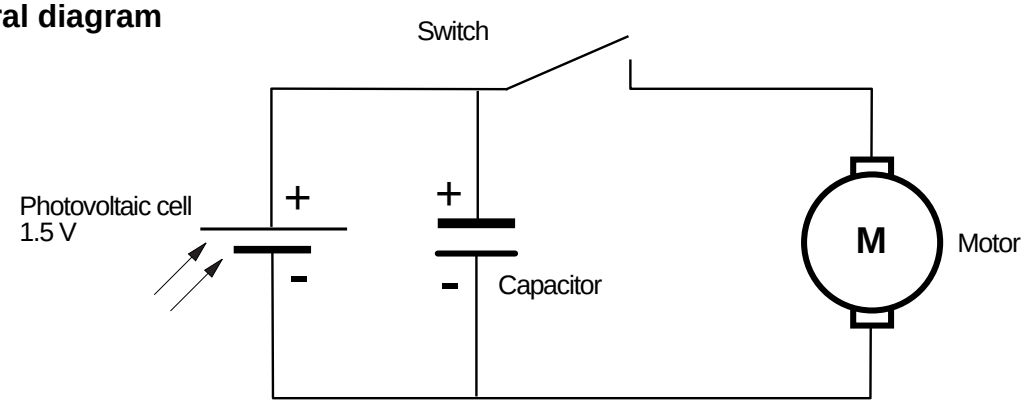


Without capacitor option



With capacitor option

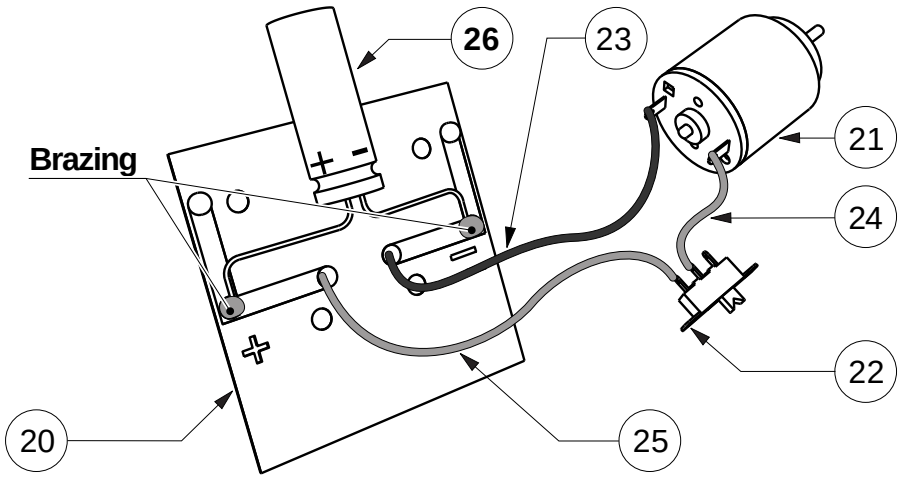
Structural diagram



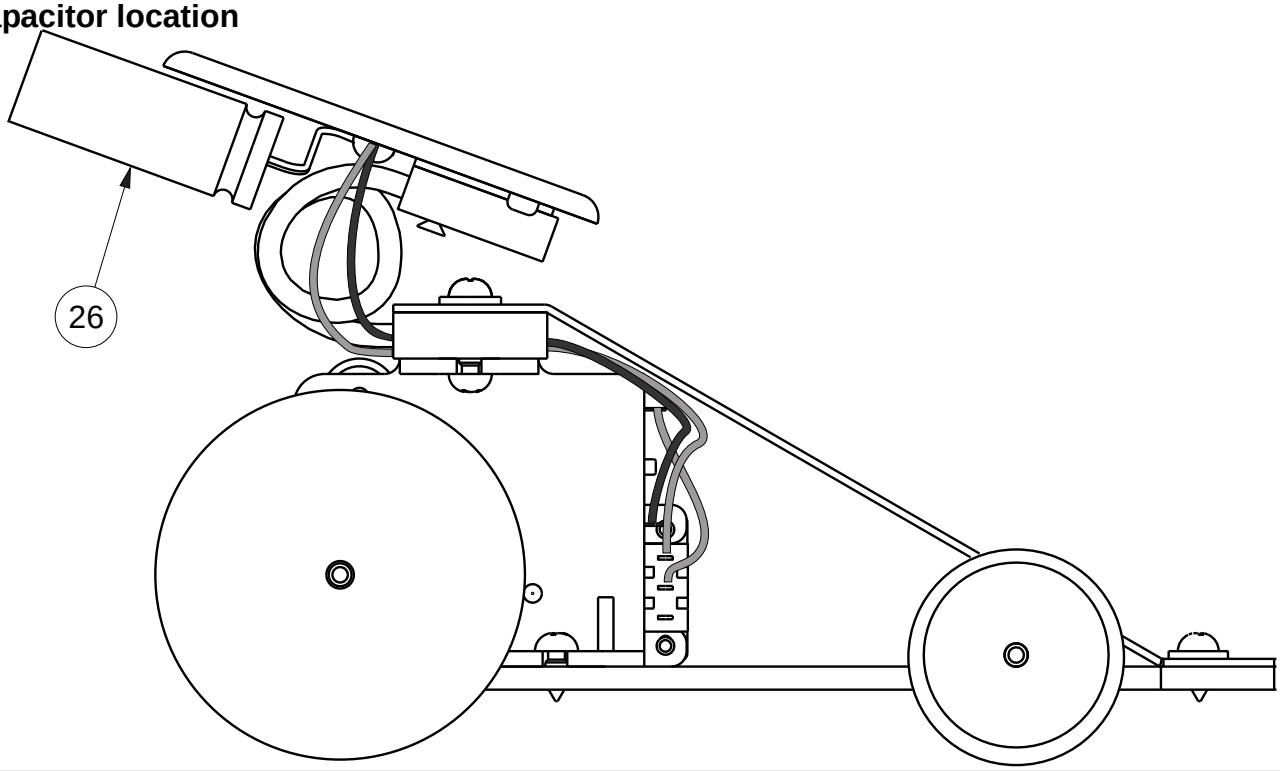
Wirig scheme

- Capacitor (Mark 26)

- Photovoltaic cell (Mark 20)
- Motor (Mark 21)
- Sitch (Mark 22)
- Black wire (Mark 23), length 140 mm
- Red wire (Mark 24), length 15 mm
- Red wire (Mark 25), length 125 mm



Capacitor location



TECHNOLOGY AT SCHOOL	Scale 1 : 1	A4	PROJECT: SolDrag
	School / Class		PART: Capacitor option
	Name / Date		DOCUMENT TITLE: MOUNTING OF THE SUPER CAPACITY CAPACITOR