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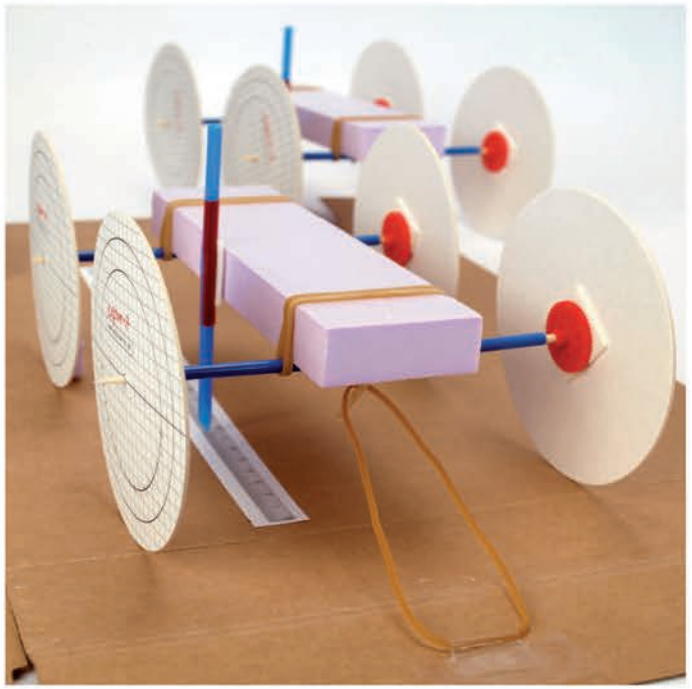
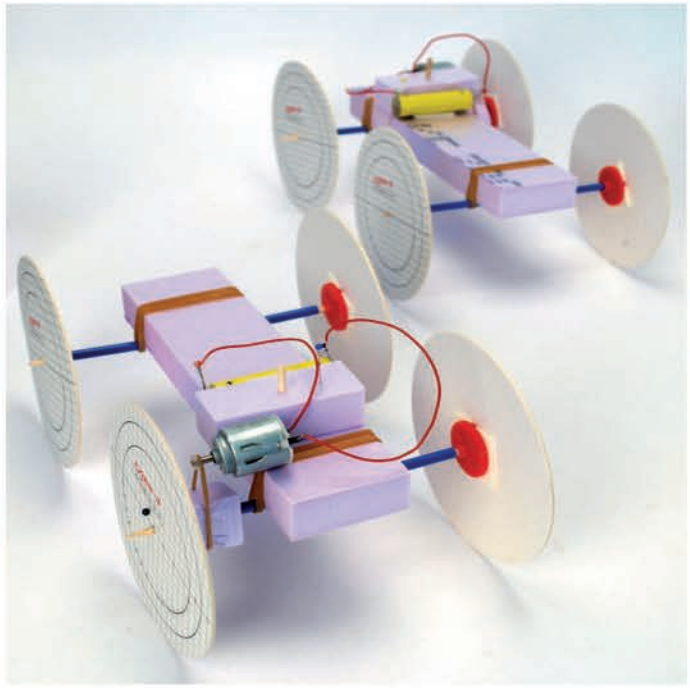
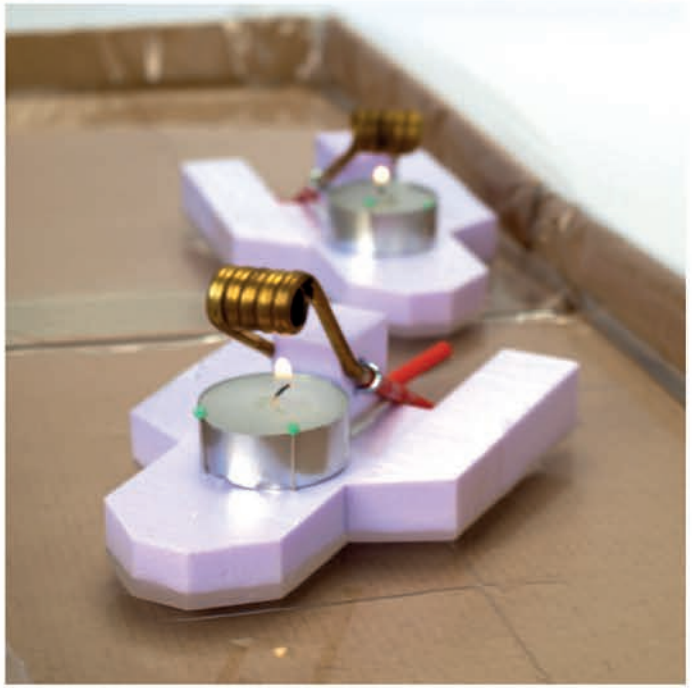
Technik be-greifen
Com-prendre la technique
Grasping technology



Energy for mobility

Energy of position
Elastic energy
Electrical energy
Thermal energy





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explore-it Technik be-greifen
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explore-it a research and development project
of the Schools for Teacher Education of Valais (PHVS) and of the University of Applied Sciences Northwestern Switzerland.

explore-it a charitable association
The service agreements with the supporters of explore-it stipulate beginning with the project status that explore-it will become a provider of teaching and learning materials. It was not possible to provide materials and services for sale, being a research and development project of the Schools of Education. For this reason, the association was founded in cooperation with the partners of explore-it. The goal of the association is the promotion of technical understanding and natural sciences for children and youth. The association is exclusively non-profit and is tax-free since February 2010. The explore-it materials are assembled at the ARWO (sheltered workshop for persons with disabilities) in Wettingen in Argovia, Switzerland.

Contact: Verein explore-it, Hauptplatz 16, 3953 Leuk Stadt, mail@explore-it.org

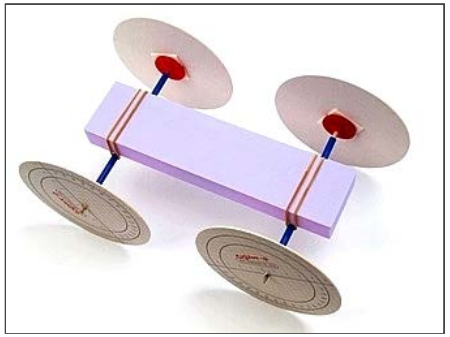
Energy for mobility

Energy of position

Energy for mobility – ... explore

...explore: Construct your own ultra light sports car

Construct an ultra light sports car in order to find out how much energy is available in a difference in height.



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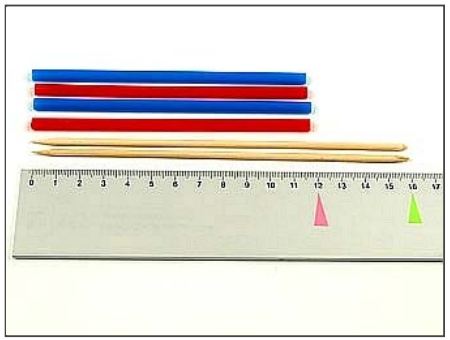
Construct your own ultra light sports car

Materials

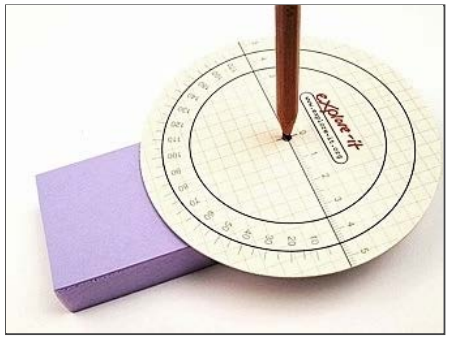
- 4 round cardboard discs
- 4 large plastic gears
- double sided tape
- 2 wood skewers
- 4 drinking straws
- a long piece of hard expanded foam
- 2 rubber bands
- 4 curved nails ("agraffes")
- pencil, scissors, sharpener or knife



- Cut 12 cm off of the long ends of four drinking straws.
- Cut both wooden skewers at a length of 16 cm and sharpen the cut end with a sharpener or a knife.

- Cut open two of the drinking straws along their lengths (shown here with the red straws)
- Insert the cut open drinking straw (red) into the not cut open drinking straw (blue). Now you have two supports for the moveable wheel axles.

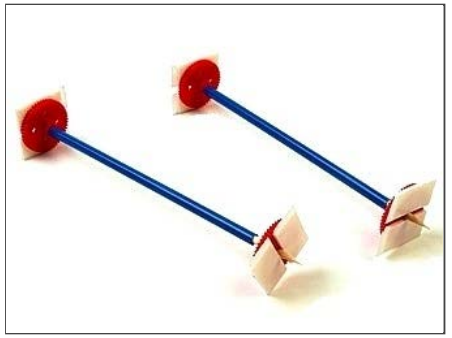
Video Instruction "Construction of the Axles"



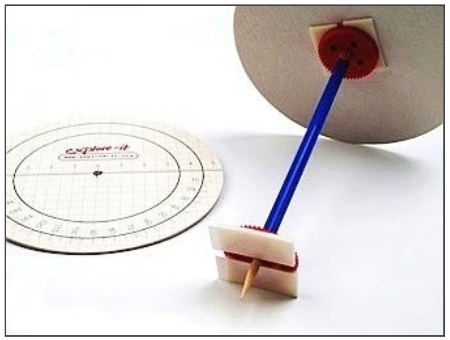
- Perforate the four cardboard discs in the middle using the pencil or the skewer.

- Insert the skewer into the drinking straw (axle supports).
- Attach a plastic gear onto each side of the skewer. The flat side of each gear points outwards.

Video Instruction "Construction of the Axles– Part 2"

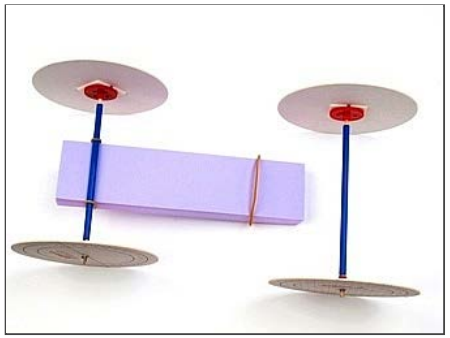


- Attach two pieces of double sided tape to the flat outside surface of each gear

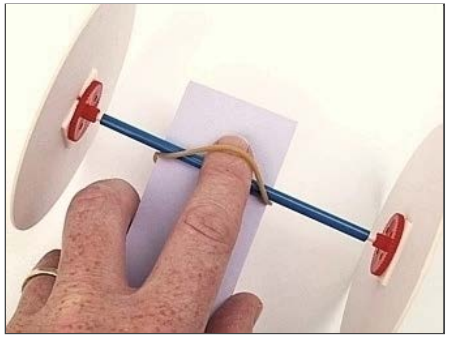


- Remove the protective plastic from the double sided tape and attach a cardboard disc to each of the gears.

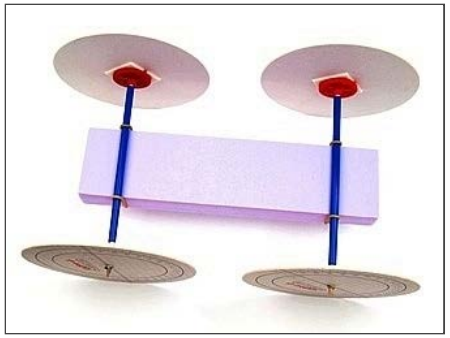
If you hold the axles by their axle supports, the wheels should turn easily "without" resistance.



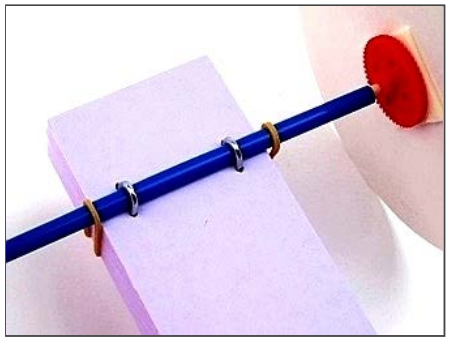
- Pull the rubber bands over the ends of the long piece of foam.
- Place the axles on the foam outside of the rubber bands.



- Pull the upper part of the rubber band over the axle and over the end of the piece of foam.

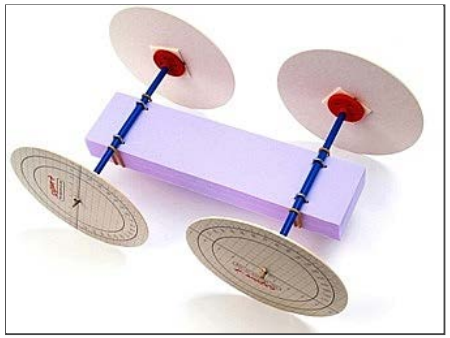


- Repeat for the other axle.



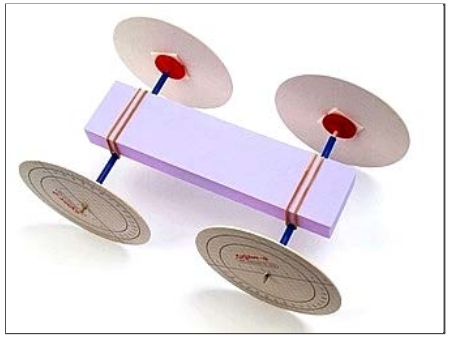
- Attach both axles with two curved nails ("agraffes") each

Ensure that you don't block the free movement of the axles when you press the curved nails around them.



- Confirm once more that the wheels rotate easily.

Videoanleitung "Reibung optimieren"



- Turn over the vehicle. The axles are now underneath the piece of foam.

- The racer is complete!

Experiments with the ultra light racer
(conduct each experiment several times)

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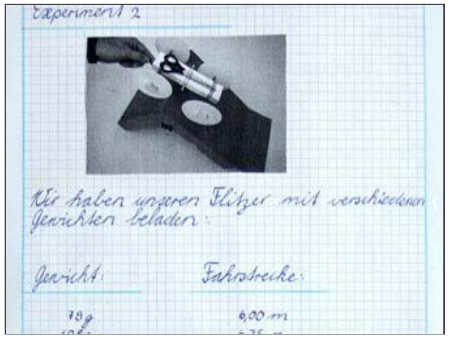
First experiment

Using the lid and the bottom of a cardboard box, construct a ramp. Lay the racer on this ramp and carefully push it over the edge, until it rolls on its own. Mark the distance over which the racer rolls on the smooth floor.

- Can you improve your distance record using any clever tricks?
- Who holds the distance record of your class?



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Second experiment

Load up your ultra light racer with weights, for example, with small scissors or glue sticks.

- Does the weight have an influence on the distance over which the racer travels from the same starting height?

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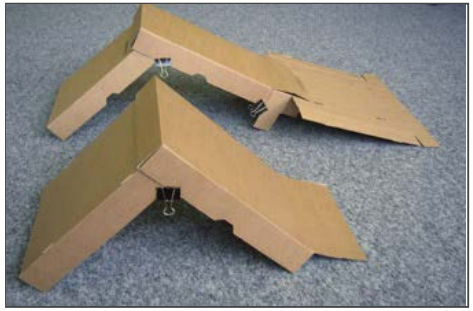
Third experiment

- Attach "sails" ("air-brakes") of various materials and shapes using wooden skewers.
- Test the effectiveness of these brakes on your racer under the same conditions (from the same starting height).

  Which "air brake" has the greatest effectiveness on your racer?



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Fourth Experiment

- Construct several ramps of different slope, but which all have the same height. You can construct these using clothespins to pinch together the boxes, or using two pins which stick through the cardboard at the overlaps between boxes.
  Does the slope of the ramp, while holding the starting height constant (same gravitational potential energy) have an influence on the distance traveled by the racer?

  Do you see any correlations?

Energy of position: Invent

Energy for mobility – ... invent

...invent: Your ultra light racer on the broad jump

You can construct a jumping ramp for your ultra light racer in the gymnasium, with which you can learn a lot and present an exciting jumping demonstration.

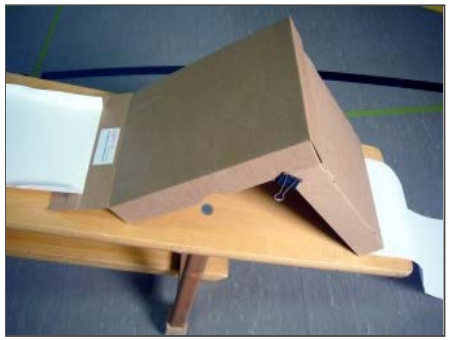
explore-it

Construct a jumping ramp

Materials:

- Lid and bottom of a cardboard box.
- 2 pins for attaching the cardboard box portions together.
- approx. 20 sheets of A4 paper (used paper also useable here)
- tape, coloured chalk
- notebook, measuring tape or long ruler
- in the gymnasium: a long bench and a climbing wall

- The bench is lifted to chest height and hooked into the climbing wall in order to make a banked surface.
- In order that the vehicle does not fall from the bench we tape paper to the bench and fold up the edges (approx. 2 cm) in order to make a chute
- In order that the vehicle is correctly led down the chute, the flat width must increase progressively down the ramp. If you fold the edges up on an entire pile of paper together then the flat widths of the upper sheets of folded paper will automatically be more narrow than those of the lower sheets of paper.



- The jump platform is made from the lid and bottom of the cardboard box, joined together with two binder clips
- You can tape this platform to the chute
- Attach a paper lane to the area where the vehicles land.

- Colour the contact surfaces of the wheels using coloured chalk.
- The wheels will leave a coloured marking when they land, with which you can measure the jumping distance exactly.

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...invent: Who will become the broad jump champion?

Using this setup you can now vary the geometry in order to find out how a longer jump can be made.

Vary the following:

- the length of the approach
- the steepness of the approach
- the angle of the jumping platform
- ...

Important: only vary one thing at a time in order to know why your vehicle behaves differently. The best way to do this is to take notes about what you vary and its effects.

Incredible: Fourteen year old Aaron Fotheringham has been handicapped since his childhood. Riding his wheelchair, he was the first to have ever performed a backflip/back somersault. Not only was perfect operator movement required for this jump but also a cleverly designed ramp geometry was needed. In the following tasks you can only perfect the ramp, because a driver who could help on the jump cannot sit on the vehicle.

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...invent: your jump demonstration

How about a class competition in which the vehicles and the ramp are improved in order to make "impossible" possible:

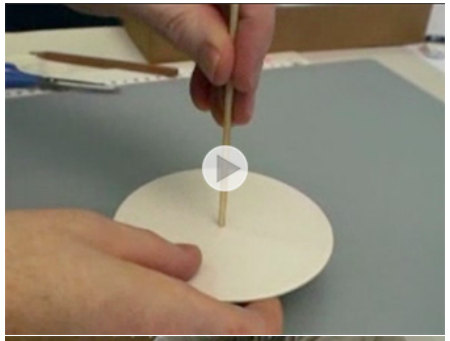
- Highest jump
- Back somersault
- A "360 horizontal" under artificial lighting
- ....

Important for competitions:
The jumps should be repeatable. A jump, which can't be presented twice in a row, doesn't count.

Photograph or film your ultra light racers, the ramps and the jump. Send us your pictures or your short videos. We look forward to your ideas and your experiments, even if they aren't completely successful.

Lage - Energie, Energie de position, Energia potenziale, Energy of position

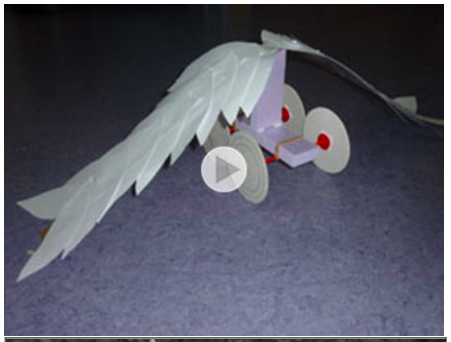
... erfinde: Galerie
... invente: Galerie
... inventa: Galleria
... invent: Gallery



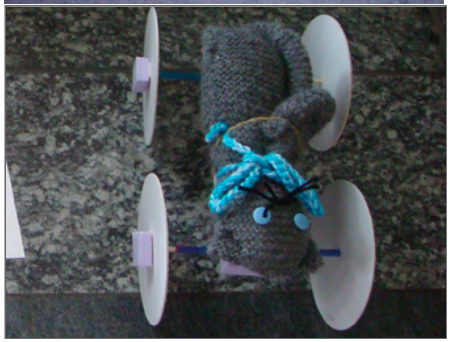
Kartonscheibe
Das Zentrum einer Kartonscheibe finden.

Ballonantrieb
La voile de Colin a été très efficace. Il écrit: C'est peut-être parce qu'elle est en mousse, sa taille a peut-être fait qu'elle a capté tout l'air projeté.

Des voiles pour aller plus vite!
Les enfants écrivent: L'embout large n'est pas efficace car l'air part de tous les côtés.



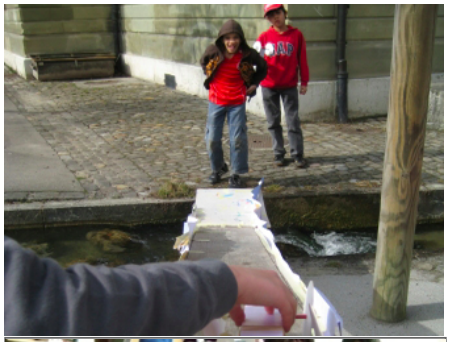
Engel auf Rädern
"Wir versuchten die Flugweite unseres Flitzers mit Hilfe von Verschiedenen Flügeln zu verlängern" schreiben uns die Erfinderinnen der 6. Klasse in Tübach.



Sprungmaus
Aus Gsteigwiler haben wir das Foto dieser Kreation erhalten.

Flitzer
Bereit zum Experimentieren

Ein nasses Hindernis
Sogar ein Bach wird übersprungen.



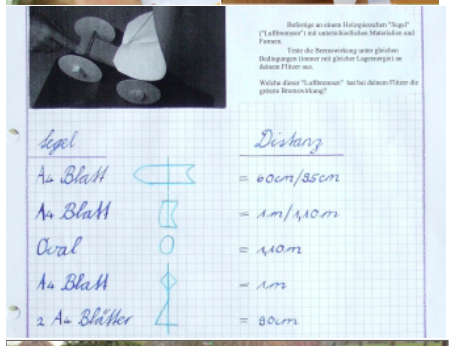
Da braucht‘s keine Brücken mehr
Diese Klasse von Dominic Urben aus der Matte bei Bern, überquert einen Bach mit den Flitzern. Ob wohl alle die Distanz meistern konnten?

Wer kommt am Weitesten?
Der Flitzer mit den besten Rolleigenschaften, das heisst mit der geringsten Reibung und der am besten eingestellten Fahrspur, wird in Bülach am weitesten gekommen sein...

Sprünge
Welches Fahrzeug "fliegt" am Weitesten?

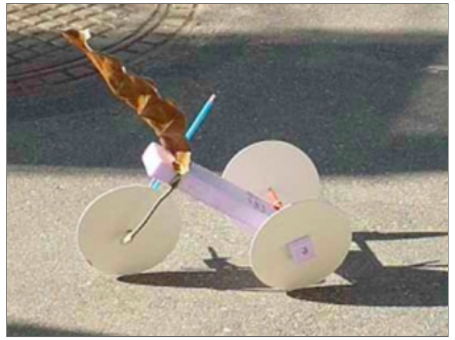
Mutiges Hindernis
Die Schülerinnen und Schüler der 6.Klasse von Pius Schmid wollten es wissen und haben sich „wagemutig“ unter den Absprung der Schanze gelegt.

Ein Segelboot auf Rädern?
Die beiden 6. Klässler aus Baltschieder wollen den Wind nutzen, um auf dem Pausenplatz zu "segeln".



Welches Blatt bremst am besten?
Die Klasse von Heinz Schelb aus Gsteigwiler wollte es genau wissen und habt den Luftwiderstand von verschiedenen Blattformen erforscht.

Luftwiderstand ausnützen
Das Segel wirkt nicht nur als Bremse auf der Rampe bei den ... erfinde - Aufgaben. Die Fahrzeuge werden dank dieser Segel vom Wind angetrieben.



Blatt
Auch ein Blatt kann als Segel dienen.

Energy of position

Energy for mobility ... and more

... and more: Rolling downhill and saving energy?

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1.1 Task:
The thought is fascinating: the vehicle rolls downhill and produces energy. Is that possible?

Research on the internet and explain using a wall chart (a large diagram), how vehicles can accumulate energy by rolling downhill.

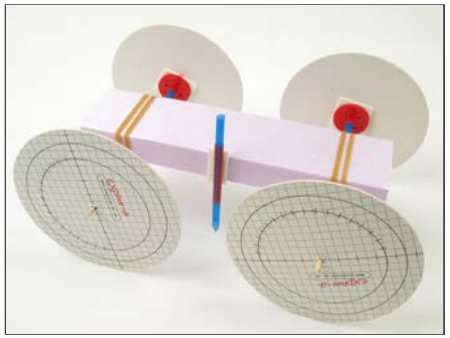
Sources:
Wikipedia: **History of the roller coaster**
Wikipedia: **Regenerative brake**

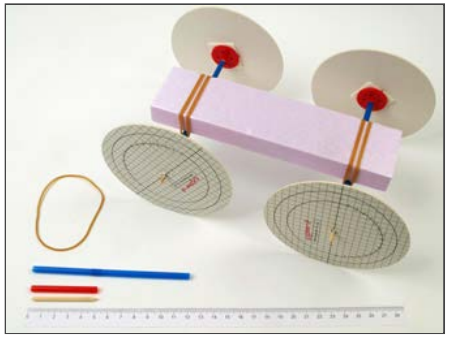
Elastic potential energy

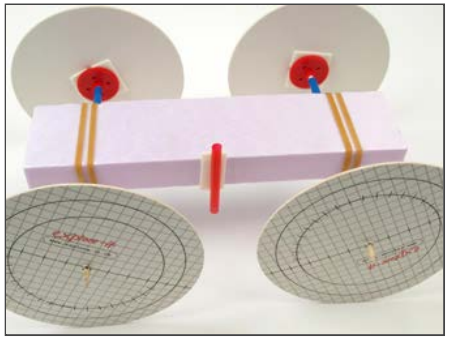
Energy for mobility – ... explore

...explore: going forwards, relaxed.

Elastic potential energy is found in many things: In a spring, paper rolls, in a football, in a branch, in a pillow, in a blade of grass... and of course in every rubber band. Elastic potential energy exists in every body that returns to it's formal position after deformation.







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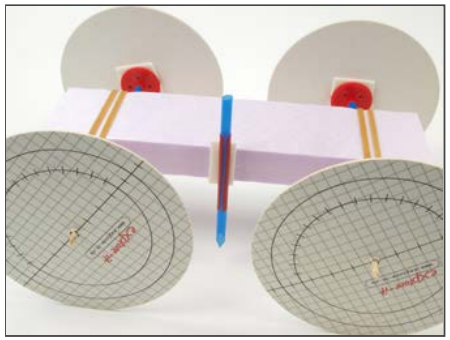
Build a catapult car

Transform your racer into a catapult car in a few manipulations.

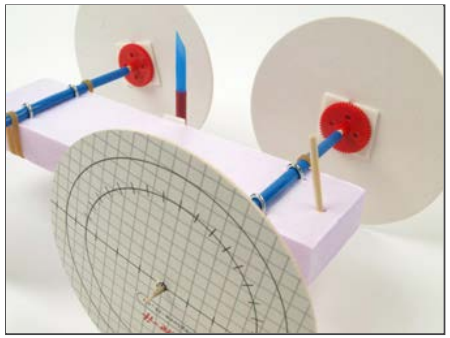
Materials for the catapult car

- racer
- 2 drinking straws
- a long rubber band
- a piece of a wooden skewer
- double sided tape
- measuring tape

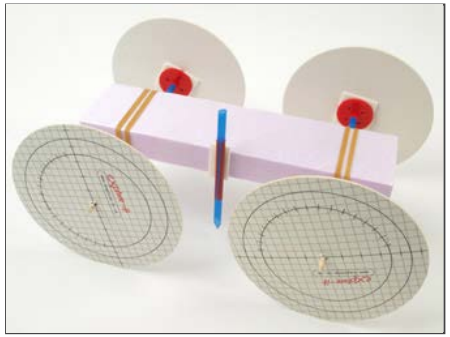
- Attach a 5 cm piece of drinking straw using double sided tape on the side of the racer.
- Cut the straw open along its length.



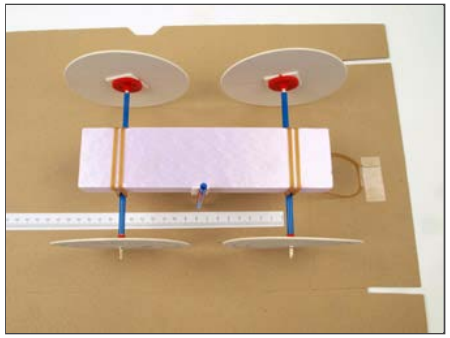
- Cut a second piece of straw about 13 cm long. Cut one end of this straw in the form of a sharp arrow.
- Push this "arrow" – with the arrow tip pointed towards the bottom into the cut open straw.



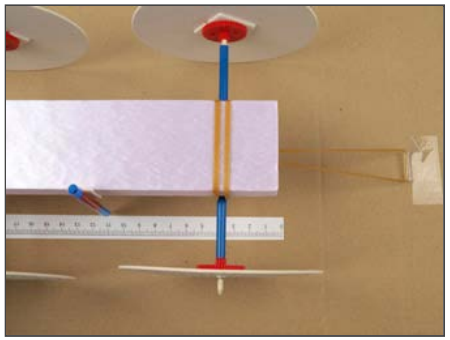
- Turn the vehicle upside down.
- Insert a well sharpened wooden stick of about 5 cm length underneath the car at one end.
- This wooden stick must be slightly tipped towards the wheel axle and must go through the entire foam piece.



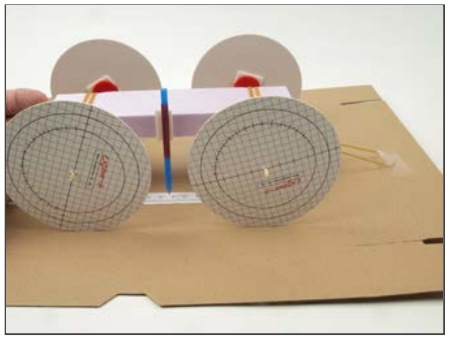
- Turn your vehicle over, and it is ready for its first catapult trip!



- Attach the measuring tape on a flattened out box or lid.
- Attach a rubber band on top of the cross fold of the flattened box using some sticky tape.



- Hook the rubber band on to the wooden stick under the vehicle and stretch it.
- Adjust the height of the arrow on the side of the vehicle such that it's tip is just above the measuring tape.



- Using the measuring tape and the arrow on the car you can monitor both the extension of the rubber band and the amount of power of your catapult car!

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Experiment
How reliably does your catapult car travel?
Compare the distances which your vehicle travels when extending the rubber band by the same amount.

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Experiment
How is the distrance traveled affected by increasing the extension of the rubber band?
Compare the traveling distances of your catapult car while varying the extension of the rubber band.

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Experiment
How could you predict the traveling distance of your vehicle?

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Experiment
What is the longest distance which your catapult car can travel?

Elastic potential energy

Energy for mobility – ... invent

Switzerland, the land of the chocolate manufacturer, sells chocolate all over the world. For this reason the merchandise must be transported. Either by train, lorry, ship, airplane, on foot, by bicycle, or on the back of a horse.
All the forms of locomotion (mobility) need energy. The train needs electric current, the sailboat requires wind, and you need food to walk. Working as a *transport contractor* (that is how we call the owner of a transport vehicle), build your own cargo vehicle using the elastic potential energy of a balloon as the only source of energy.

Who can tell how far this balloon transport has come?

explore-it

...invent:
Transport chocolate with a balloon – elastic propulsion
Classroom competition

Team, vehicle

- You may work alone or in groups of maximum size 3.
- You can use the same vehicle built during the ...explore tasks, a self made invention or an already existent vehicle.
- The load transporter will carry a 100g chocolate bar.
- The vehicle will only be powered by one balloon. This balloon can be cut apart, put back together, twisted...
- Each vehicle receives a standard commercial balloon of 33cm diameter, which must be installed into the vehicle within 5 minutes.
- The balloon is the only source of energy allowed – no motors, no pushing and no blowing is permitted.

You can use the elastic potential energy of the balloon in many different ways, not only inflated. For example, you can transform it into a long rubber band. The elastic potential energy is the drive train of your lorry.

The start and how to measure the distance traveled

- The tip of the vehicle is set at the starting line on a smooth floor, like in a gymnasium.
- The vehicle may not be pushed but only released: it must start on its own.
- After the start you may not touch the vehicle anymore.
- The inventor stays behind the starting line and may only go the vehicle once it has come to a full stop.
- No installations are permitted on the floor past the starting line.
- The length of the run is measured from the starting line to the furthest point that the vehicle has reached.
- The three longest runs are measured (in centimetres) within a time limit set by all the teams.
- The average of the three longest runs is calculated (in centimetres and millimetres), which serves as the competition result.

Prize ideas

Awards may be given for different categories.

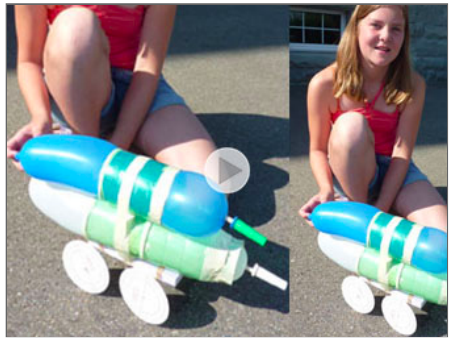
- Longest run
- The most original transport vehicle, with the most original transport means and the show to go with it.

Please send us an e-mail with the results for your competiton. Take the average of the three longest distances traveled. It would be nice if you attach photos of the team and of the vehicle, and attach a short video in which the vehicle is quickly presented. Show in the film how the cargo vehicle is replenished with energy and how it travels.

Elastische Energie, Energie potentielle élastique, Energia potenziale elastica, Elastic energy

... erfinde: Galerie
... invente: Galerie
... inventa: Galleria
... invent: Gallery

Ballonflitzer
Dass und wie ein Ballon unseren Flitzer antreiben kann, war uns schnell klar. Mehr Kopfzerbrechen bereitete uns die Befestigung des Ballonantriebs. (Lara, Helena und Lisa)

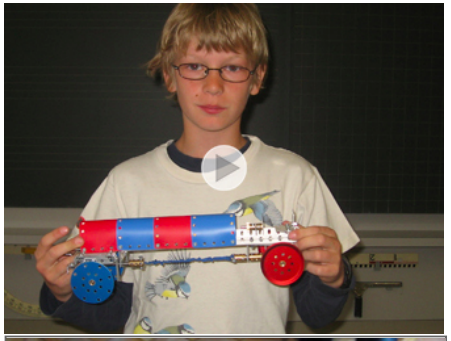


Luftballonantrieb
Die Idee vom Luftantrieb war schnell geboren. Einiges an Kopfzerbrechen und Erfindergeist forderten uns die Befestigung des Ballons auf dem Flitzer sowie der möglichst stark antreibende Luftaustritt ab. Wie man sehen kann, funktionierte es schliesslich indem wir mit einem abgeschnittenen Strohhalm die Luft dosierten

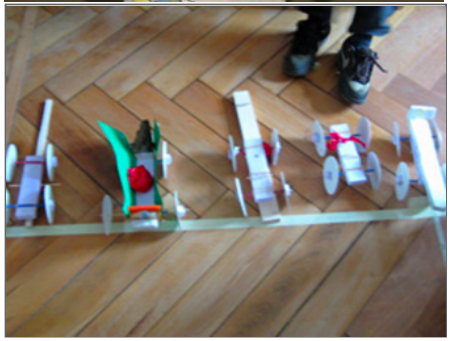
Flitzer mit Segel
Die Öffnung eines Ballons ist auf das Segel des Flitzers gerichtet.

Wettbewerb Klasse Caroline Haag

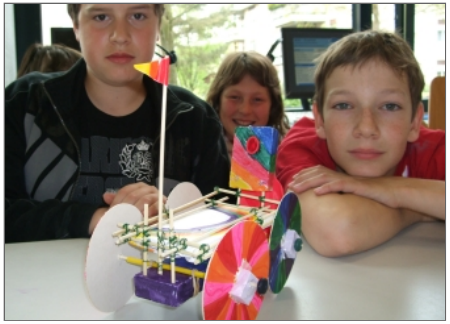
Ballonpower aus der Flasche
Die Jungs aus der Klasse von Cornelia Freitag haben mit Hilfe des Ballons und einer PET-Flasche einen Propellerantrieb gebaut.



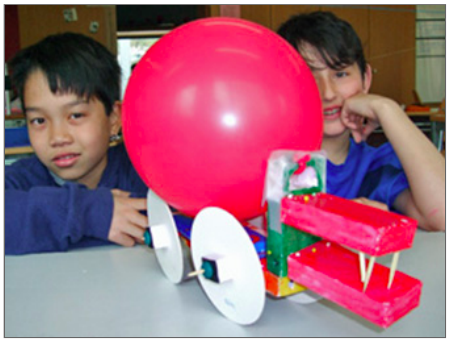
Meccano-Transporter
Dieses Fahrzeug wurde mit dem bewährten Meccano-Bausatz gebaut und überträgt die elastische Energie des Ballons (hier blau) auf die Radachse.



Boliden am Start



Tolles Chassis
Die Jungs bauten mit Grillspiesschen einen Aufbau, in den man die Schokoladetafel bequem versorgen aber auch wieder wegnehmen kann. Das ist natürlich wichtig- man will sie ja natürlich auch essen können.



Das Ballon-Krocki

Das sind die Rekordhalter:
Mit einem Ballon eine Tafel Schokolade soweit wie möglich wegbefördern. Die Gruppe aus Bülach hat in der Turnhalle 21 Meter geschafft.

LEGO-Express
Unterhalb des Chassi wird ein Gummizug gespannt und dient so als Motor. Befestigt ist ein Ende unter den vordernen Rädern und das andere an der Hinterachse. Beim Rückwärtsfahren wird der Gummi gespannt und ab gehts...

Spicker
Ein Ballon wird als Gummiband eingesetzt und sorgt für einen rasanten Start.

PET-Flaschen-Racer
Hier dient den Mädchen aus der Klasse von Caroline Haag eine PET-Flasche als Chassis. Auch die Räder stammen von gebrauchten Flaschen- ein richtiger Getränke-Transporter.

Ein kleiner Unfall
Manchmal fliegen die Bauteile durch die Luft

Elastic energy

Energy for mobility ... and more

... and more: Where is elastic energy implemented?

Springs, rubber bands or also stretched wood, all store energy and translate energy into motion. One example, of which you know for sure, is the slingshot.

explore-it

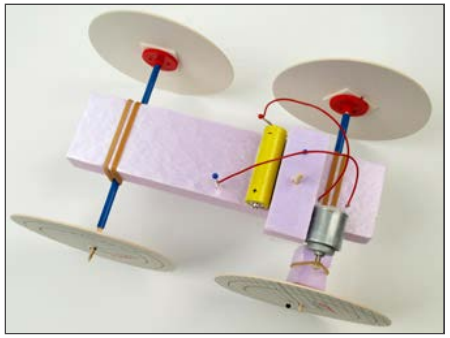
2.1 Task:
Research on the internet for other objects and situations in which elastic potential energy is applied. Keywords such as "clockwork motor", "rubber band motor", "rubber powered", and "spring motor" will help you for sure. Make a list of the names of the objects and in case its possible to print, include pictures. Try to explain how elastic energy is implemented in each example.

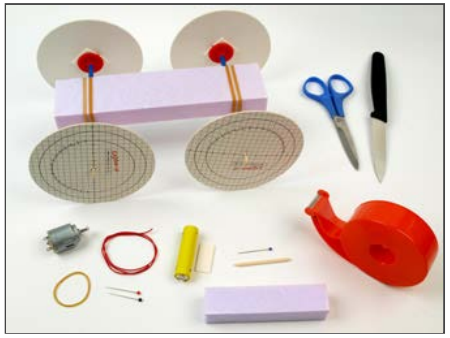
Electric energy

Energy for mobility – ... explore

...explore: My own electric car

The future belongs to the electric car. This is what many experts all over the world say today. Electric vehicles use energy 2 to 3 times better than vehicles with internal combustion motors. "Traditional" motors burn off most of their energy. There are of course still a few problems to solve (with electric mobility). Two problems are improving battery performance and obtaining enough electricity from sun and wind. A third challenge is building lightweight vehicles which are still safe.





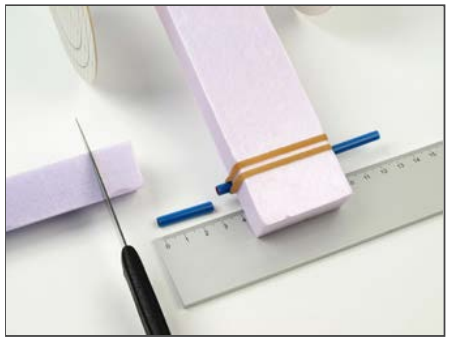
explore-it

Build yourself an electric car.

First construct a second ultralight race car, to convert into an electric car. Install an electric motor onto it and build a power transmission onto the wheel axle.

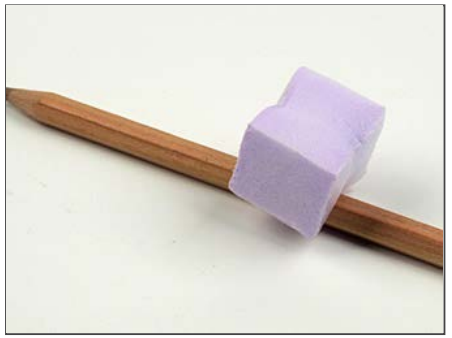
Materials for the electric drive

- One ultralight race car
- One motor including transmission connection
- A short rubber band
- 4 pins
- Some wire
- Battery with 2 Magnets and double sided tape.
- A portion of a wooden skewer
- A piece of foam stick
- Sticky tape, Scissors, Knife

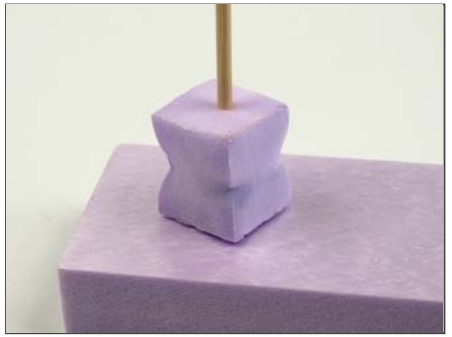


Construction and installation of the transmission wheel

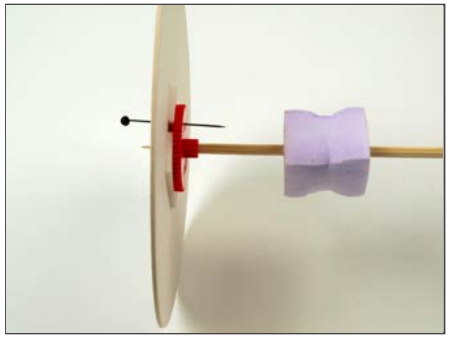
- Remove one axle from the racer.
- Shorten the drinking straw by 3 cm.
- Cut off 3 cm from the foam stick.



- Indent the foam cube using a pencil or the edge of a table. The indentation should not be deep.
  This indented foam cube becomes the "transmission wheel" with a running groove.

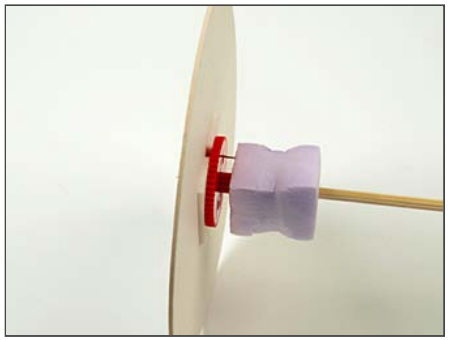


- Pierce the foam cube (transmission's wheel) in the middle with the wooden stick (wheel axle).



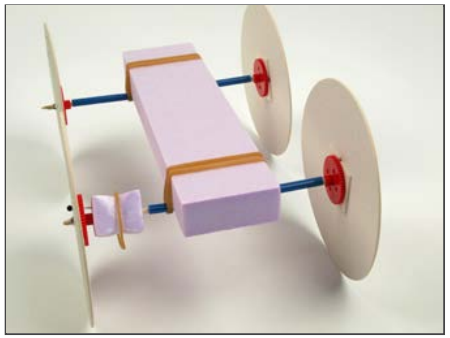
- ... and push it onto the axle.

- Attach the wheel back onto the axle.
- Insert a pin through the wheel from the outside and through one of the holes in the pinion.

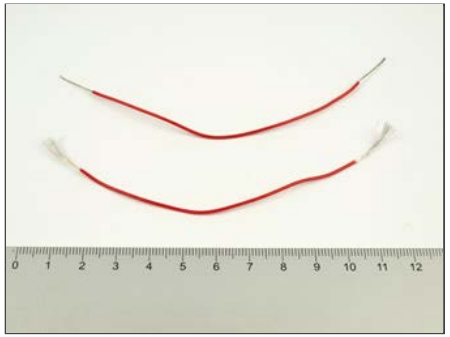


- Slide the transmission wheel up to the pinion.
- Push the pin through the foam stick as far as you can. Now you have secured the transmission wheel to the wheel axle.

Video instruction "Installation of the transmission wheel"

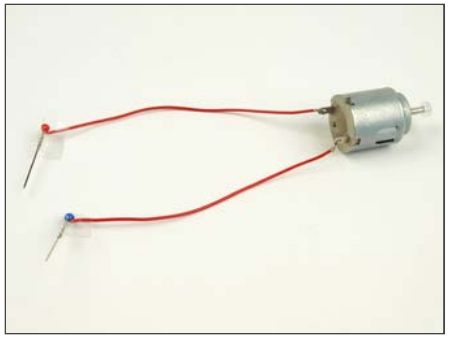


- Put the rubber band around the transmission wheel before assembling the wheel axle.
- Insert the axle in the shortened axle support (drinking straw) and put the second wheel onto the axle.
- Test to see if the wheels still turn easily after this construction.



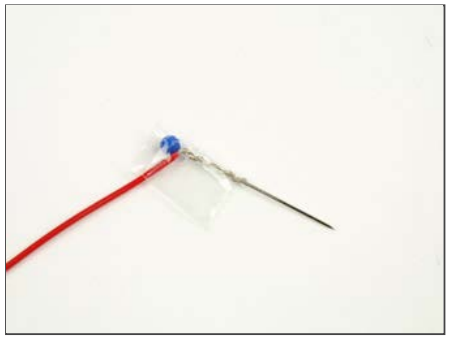
Installing the electric motor

- Cut off two 12 cm pieces of wire.
- Remove the insulation from the ends of the wires.
- Twist the bare ends of the wire between your thumb and index finger in order to form a rigid connection.



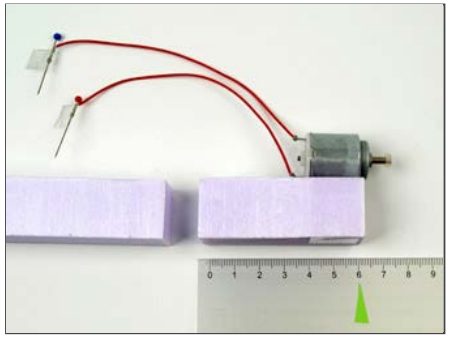
- Attach the two wires to the electric motor.
- Attach each of the free ends of the wires to pins.

- Twist each wire through and around one of the electric motor's loops to secure the electrical contact between electric motor and the wire.

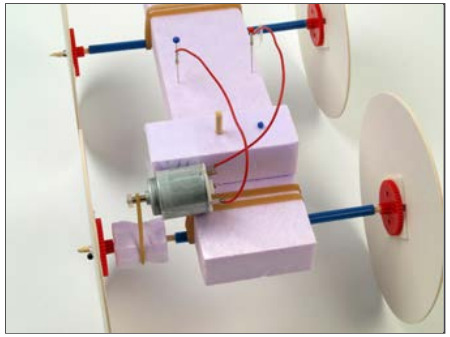


- The same applies for the connection between wire and pin. Wrap the wire tightly around the pin.

- Additionally secure the connection with some sticky tape.

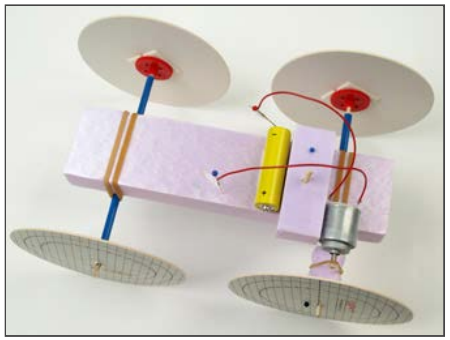


- Cut off a 6 cm piece from the foam stick.
- Securely attach the electric motor to the foam stick with sticky tape.
- The axle of the electric motor now extends over the edge of the foam.

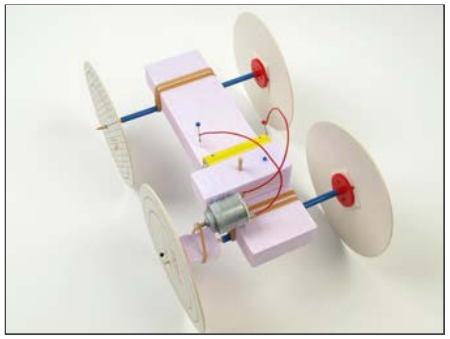


Assembly

- Place the axle of the electric motor exactly over the transmission wheel and attach the foam board to the body of the race car by piercing both with a 7 cm wooden skewer. The pin inserted next to the skewer prevents the motor from tipping over.
- Attach the rubber band (transmission pulley) around the electric motor's axle and the transmission wheel.

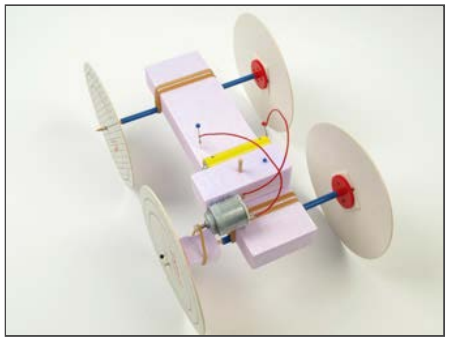


- Attach the battery (with a small magnet on each pole) with double sided tape onto the foam board.
- Close the electrical circuit by putting the pins on battery poles. The wheels start to turn.
  Video instruction "Electrification of the vehicle"



- Carefully lay the electric car on the floor – and off you go!

Experiments with the electric car



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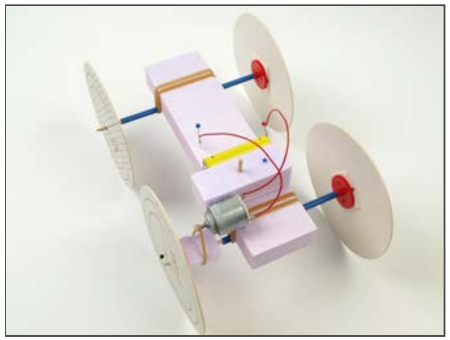
1st Experiment

How can you change the direction of travel? (forwards and backwards)



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2nd Experiment

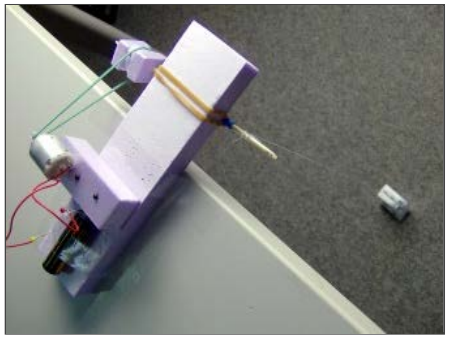
Can you find a way to modify your car so that it drives in a big circle?

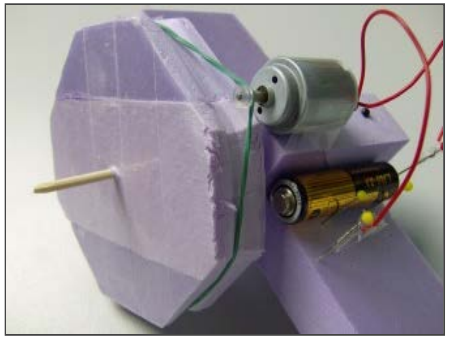
Electric energy

Energy for mobility – ... invent

...invent: A strong cable winch

You know it from the bicycle: when you put a small cogwheel on the front near the crank arm and a bigger one at the rear, you can climb a steeper mountain– but you climb more slowly using gears.
You can do the same with a winch and operate an electric cable car, cog railway, or something else...





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...invent: From the electric car to a cable winch

- Remove the wheels and one axle from the car.
- Place the winch so that the motor's axle protrudes over the table's edge.
- Tape a thread to the tip of the bare axle. And off it goes...

You can test the strength of the winch using this construction, by varying the number of metal objects being supported.

You can investigate what happens when you install different sizes of transmission wheels. In this figure a particularly big transmission wheel was used. What effect would it have?

Perform these types of tests yourself!
You can also combine several wheels.

explore-it

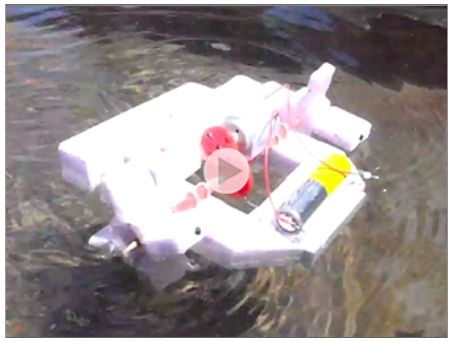
...invent:
Build a pulling device for a lift, a funicular or a cable car

Photograph or film your objects. Send a picture or a short film to galerie@explore-it.ch . We're looking forward to see your ideas and experiments even if they're not completely successful ...

In this cog railway the upper cabin is pulled uphill by a cable which is lead through rollers while the other cabin goes downhill. The cable is powered and guided at the station at the top. The weight of the cabin that descends helps to pull the cabin going up. In the picture you see in the middle the place where the tracks separate to let the cabins pass each other. More about this at Lexi-TV.

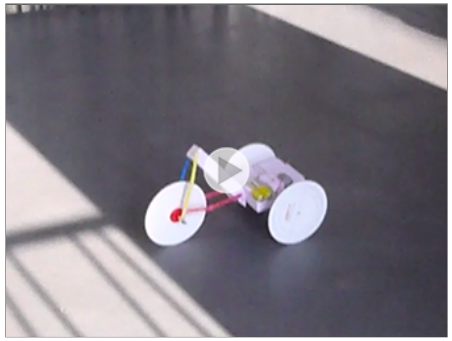
Elektrische Energie, Energie électrique, Energia elettrica, Electrical energy

... erfinde: Galerie
... invente: Galerie
... inventa: Galleria
... invent: Gallery



Schaufelräder mit Zahnradantrieb
Es war schwierig, unser Fahrzeug im Wasser auszubalancieren. Dass die Zahnräder sauber ineinander greifen, war eine weitere Herausforderung.
(Thore, Noah und Severin)

Piratenschiff
Verblüffend schnell stechen hier die Praten mit ihrem Propellerboot in See.

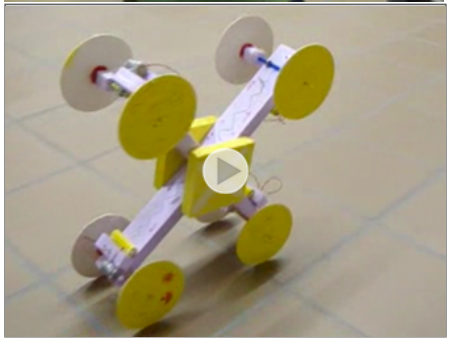


Dreirad mit Elektromtor
Bei unserem Dreirad was es schwierig, dass das Vorderrad ausreichend stabil ist und der Flitzer trotzdem richtig fährt.
(Lara, Helena und Lisa)

Rapid-Seilbahn
von Deborah und Lea (beide 10 Jahre alt)
"Wir wollten schon immer eine Seilbahn zwischen unseren Wohnhäusern haben und so ist dieses Projekt entstanden.
Wir haben gemerkt, dass es mit dem Motor in der horizontalen Lage nicht funtioniert und die Kabine darf auch nicht zu schwer sein. So haben wir eine leichtere Kabine gebaut und den Motor anders eingeklemmt.

Radrunddampfer
Yanick schreibt uns: "Nachdem wir das Tuc Tuc gemacht hatten, mussten wir ein anderes Boot herstellen. Ich habe mich für ein Boot mit einem mit Strom angetriebenen Rad entschieden, weil das niemand anderes in unserer Klasse gemacht hat und es ein ganz anderer Antrieb ist als das mit der Wärmeenergie."

Sich selber seilwindende Seilbahn
Keenan (12) "Es ist eine Seilbahn, die an jeder Seite von einer Schnur gezogen wird. Jede Schnur hat einen Motor, der das Seil aufrollt. So wird die Seilbahn auf die eine oder andere Seite gezogen."



X-Man
von Dafina (12), Gamze (12) und Linda (11)
"Wir wollten vier Fahrzeuge zusammensetzen. Dadurch kam es zu einem X. Danach wollten wir, dass das Fahrzeug, wenn es einen Unfall macht, auf anderen zwei Rädern weiterfahren kann. Das ursprüngliche Ziel war, dass es die Treppen hochfahren kann."

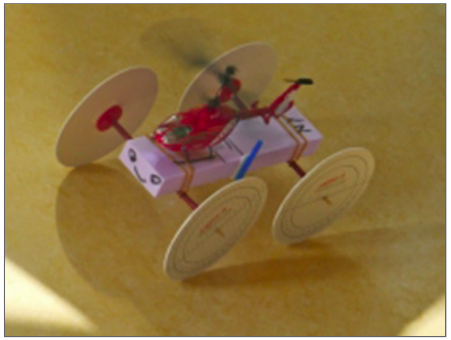
Wie fährt der da hoch?
Yanick (10) und Mete (11) stellen uns da vor ein spannendes Technik-Rätsel!

So gehts!
"Das Fahrzeug wird die Rampe hochgezogen, indem wir einen Faden an ein Holzstäbchen gebunden hatten und dieses drehte sich wie eine Seilwinde. Das andere Ende des Fadens haben wir an eine Agraffe gebunden, welche im Auto steckte.Weil die Seilwinde zu wenig Kraft hatte, haben wir das Auto zusätzlich mit einem Motor angetrieben."

Mississippi-Raddampfer
"Manchmal kommt man in den ungewöhnlichsten Situationen auf Ideen. Die Idee den Antrieb mit einer Colabüchse zu machen, wurde beim Durststillen geboren" schreiben die 6.-Klass-Mädchen aus Tübach.

Parcours für die E-Autos
"Wir haben ein Autorennen veranstaltet, den Grand Prix von Mörschwil. Aus Karton und mit Bänkli und Kissen haben wir Banden gebaut. Aber der Karton war zu schwach und als die Autos hineinfuhren, gingen die Banden kaputt. Unsere Flitzer waren sehr schnell, weil wir zum Teil zwei Motoren und vier Batterien angeschlossen hatten. Aber Kurven fahren konnten wir nicht. Und wenn man zu viele Batterien und Motoren draufpackt, ist der Flitzer zu schwer und fährt nicht mehr gut!"
Lorenzo, David und Raphael, 4. Klasse Mörschwil, SG

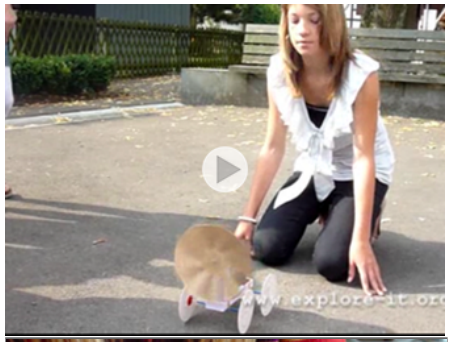
Fragen-Beantworter



Helikopterantrieb
Der ferngesteuerte Heli wird hier benutzt um das Fahrzeug in Bewegung zu bringen. Das Bild stammt von Erfinde-Coach Max Maurer. Ob man es damit auch Lenken kann?

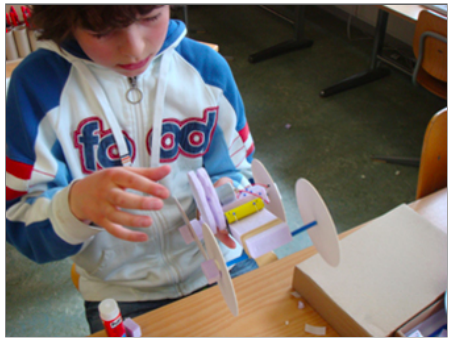
Postauto

Amphibienfahrzeug mit Propeller

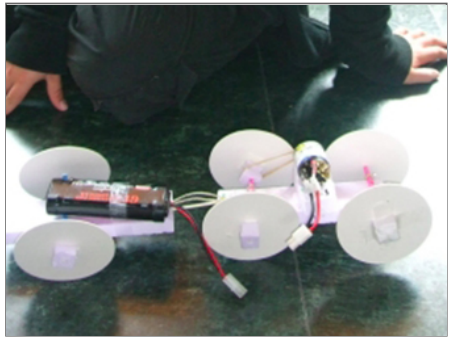


Windfahrzeug

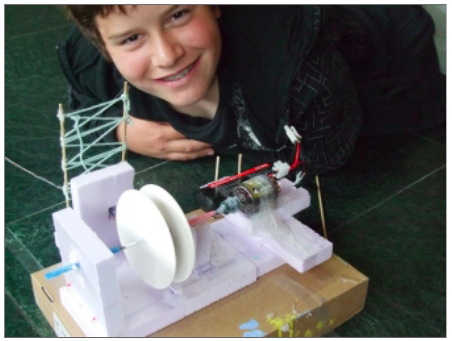
Seilbahn mit zwei Motoren
Damit das Transmissionsrad auch wirklich in Schwung kommt, haben die zwei Mädchen zwei Motoren eingebaut.



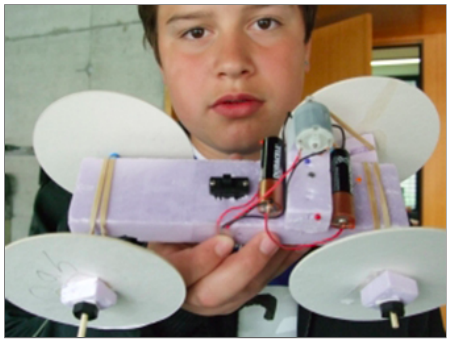
Grosse Übersetzung
Mit diesem Wagen kommt man sicher jede Steigung hoch- oder?



Power auf dem Anhänger
Ausgebaut aus einem verngesteuerten Fahrzeug kommt die Batterie hier auf dem Anhänger mit.



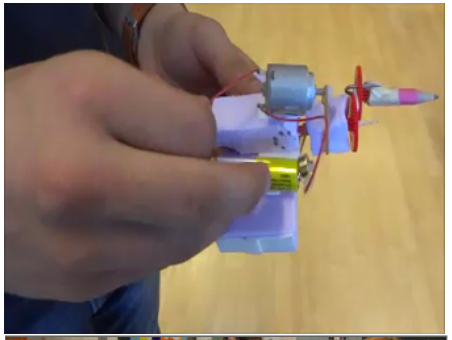
So werden auch Segelflieger gestartet
"Mit dem gleichen Motor wie haben wird auch diese Seilwinde betrieben. Marc (12) hat am Seil ein Flugzeug befestigt, das vom Seil so schnell gezogen" wird, dass es abhebt- WOW!



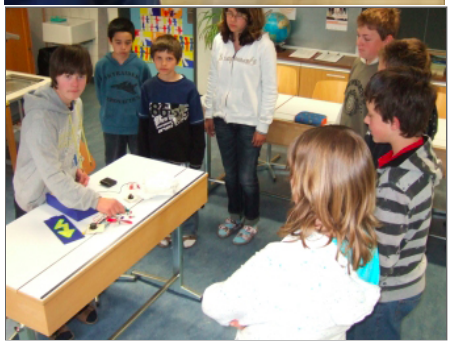
Schalter und mehr Power
Hier hat Marc noch einen Schalter verbaut und aus den beiden Batterien die in Serie geschaltet sind erhält er mehr Power nämlich zwei mal 1.5V also 3V

Die Pult-Seilbahn
Die Schülerinnen und Schüler der 6.Klasse von Brigitte Ritter haben Seilbahnen gebaut. Als Auflager für die Berg- und Talstation wirken Pulte und ein Hellraumprojektor.

Der Beisser
Das hier scheint eine spezielle Gruppenarbeit zu sein...

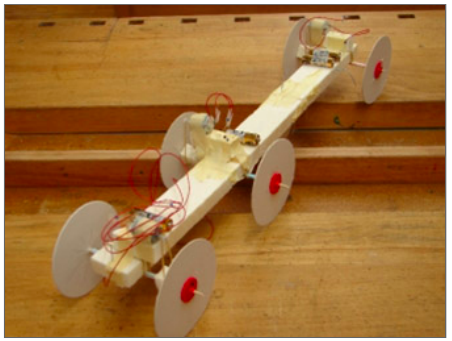


Kreiszeichner
Ein 6.-Klassschüler von Erich Schmid aus Glis hat aus dem Motorblock und der Kraftübertragungseinheit einen Kreiszeichner entwickelt. Unter Strom zeichnet der exzentrisch am Puley angebrachte Bleistift Kreise.

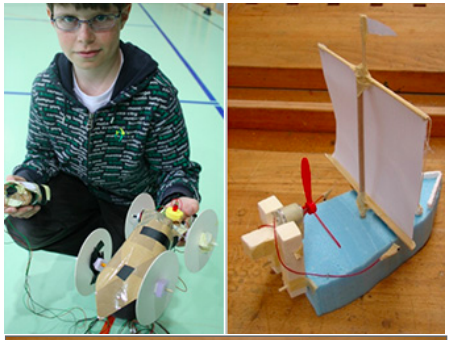


Vortrag

Kran
Das Zugseil wird hier durch Röhli geführt- so lässt sich die Reibung minimieren.

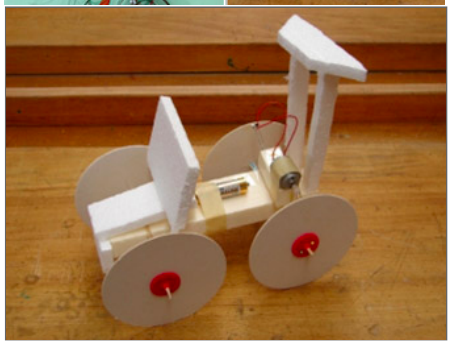


Kombination
Tatjana, Claudia, Jessi, (alle 11) aus der Klasse von Ruedi Gentsch treiben dieses Long-Vehicle mit je einem Motor auf jeder Achse an.



Ferngesteuert
Über die Kabel kann das Fahrzeug von der Batterie aus- und eingeschaltet werden. Nur sind die Energiequellen hier mit langen Kabeln versehen und durch den Einbau von zwei Motoren ist es möglich vor- und rückwärts zu fahen. Toll!

Schiff
Als Kür nach der Pflicht, dem explore-Autöli
Eric, 12
Ob das wohl so fährt - explore-it!



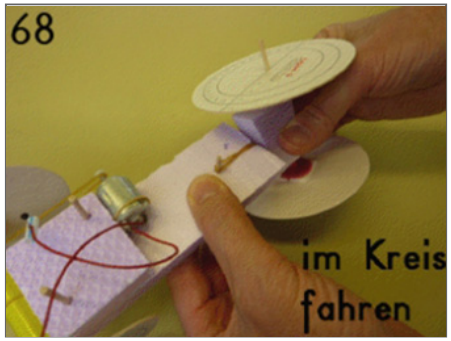
Rennwagen
von Daniel, 10

Kran 1

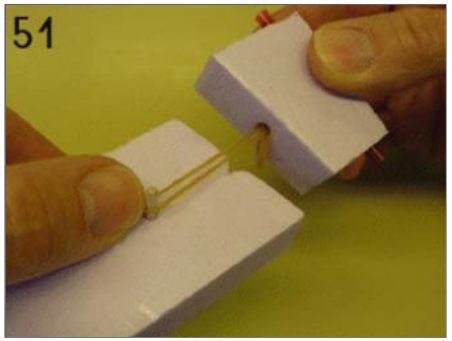
Kran 2

Fahrzeuge mit zwei Motoren

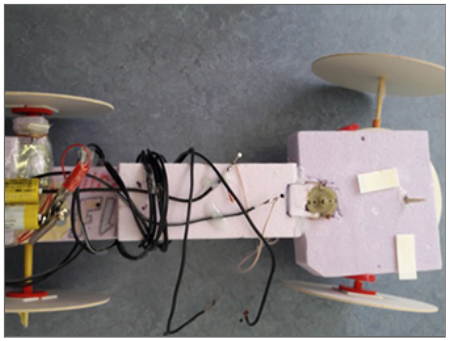
Seilbahn



Im Kreis fahren
Der Werklehrer Andi Bühlmann hat uns eine Anleitung geschickt, wie man die Achse so umbauen kann, dass das Fahrzeug einen Kreis fährt. Das Hartschaumstück ist dazu schräg zerschnitten worden und mit einem Gummi so fixiert, dass man es durch Drehen in einen anderen Winkel bringen kann.

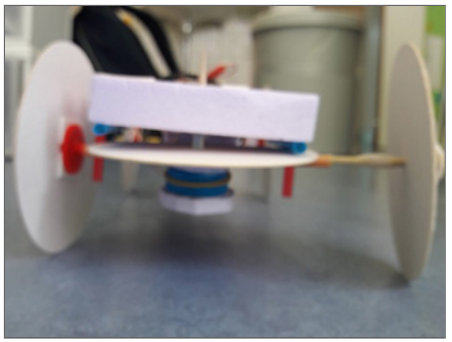


Dazu führt er einen Gummi durch das eine Teil und fixiert ihn mit einem Röhrli das im Schaum eingelassen ist. Dieser Trinkhalm dient gleichzeitig als Achslagerung- clever!!

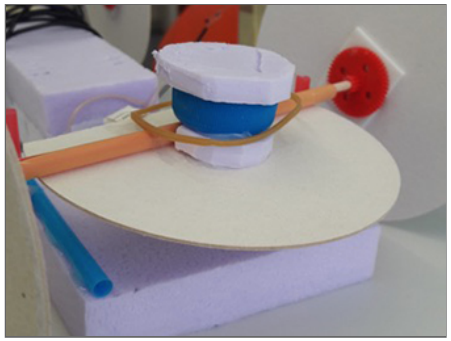


Fernsteuerung für den Flitzer
Die Vorderachse des Flitzers kann sich drehen.

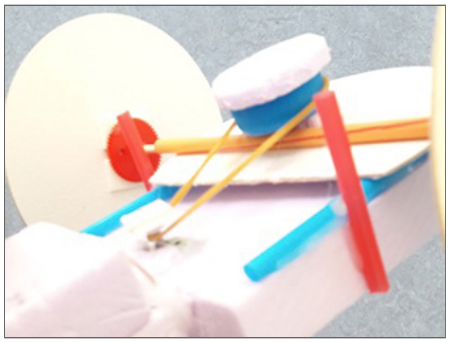
Ein eingebauter Elektromotor sorgt für die Drehung der Vorderachse.



Fernsteuerung für den Flitzer
Hier siehst du den Aufbau der drehbaren Vorderachse.



Fernsteuerung für den Flitzer
Die Drehvorrichtung von unten.



Fernsteuerung für den Flitzer
Ein Gummiband überträgt die Lenkbewegung vom Motor auf die Vorderachse.

Electrical energy

Energy for mobility ... and more

... and more: Electric vehicles are clean!

"An electric vehicle is much more environmentally friendly than a fossil fuel vehicle!“ This statement seems obvious, somehow. However can this be claimed in general?

explore-it

3.1 Task:
Try to put this statement into perspective by answering the following questions:

What are fossil fuels?
What is electricity?
Is the following sentence correct? "Electricity is generated?“ Why?
Try to describe at least three ways of environmentally friendly electricity generation.
Are there ways of generating electricity which are bad for the environment? Name at least four and try to explain why they are bad for the environment.
Based on your findings, under which conditions is a electric vehicle really environmentally friendly?

Write your answers in shorthand on index cards so that you can present them to your classmates.

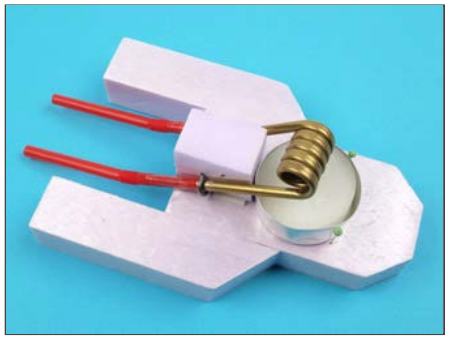
Sources:
Wikipedia: **Fossil fuel**
WIkipedia: **Electricity Generation**

Thermal energy

Energy for mobility – ... explore

...explore: On the "open seas" with a pop-pop boat

A pop-pop boat is a boat with a pulsating water engine. The simple motor operates without any moving parts. The only source of energy is a tea candle. At the rear of the boat underwater are two drinking straws side by side. Water is sucked in and out by these two drinking straws. Though the same amount of water will be sucked in as is pushed out, the boat moves forward in bursts and fits. The reason is that the water comes in from all directions but exits in only one direction.

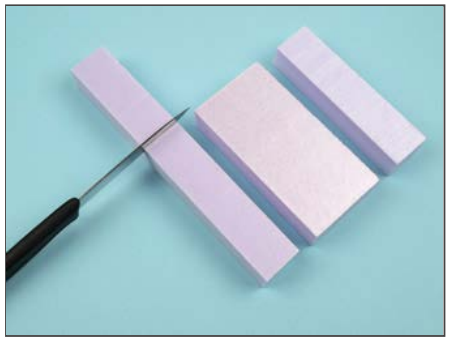


explore-it

Build your own pop-pop boat

Materials

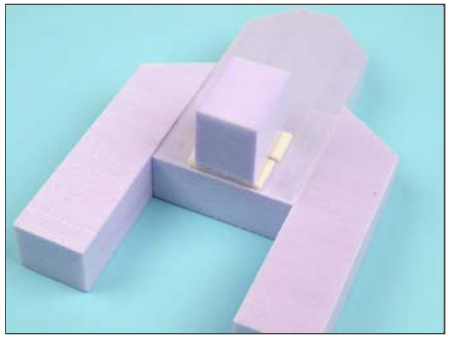
- Long and short pieces of hard foam
- Ring of brass tube
- 2 drinking straws
- 2 Pins und 2 Staples
- Tea candle
- double sided and single sided tape, knife und pencil
- A water basin or a baking mould (water depth at least 5mm)



- Cut off 2 pieces from the long foam stick
- The foam pieces must be the same length as the short foam piece.

- Place the two cut pieces one on each side of the short foam board and push them halfway back
- Attach them with some tape on top and underneath.
  Cut the boat's shape before assembling the pieces.

- Cut 2 cm from the long foam stick
- Stand this block up and attach two pieces of double sided tape on the smaller surface



- Attach the block exactly in the middle at the back of the boat form.

Long brass tube (Materials from 15.2.2011)

- If your brass tube is about 13.5 cm long, you dont have to change it.

Short brass tube (Materials until 14.2.2011)

- If your brass tube is about 7.5 cm long, you have to add two pieces of drinking straws.

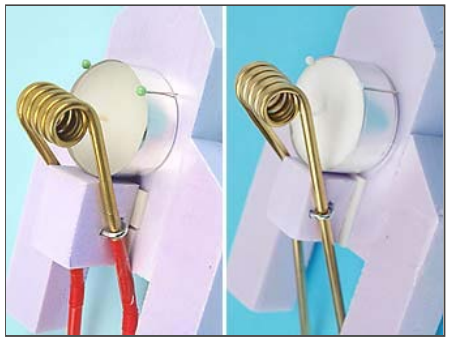
Short brass tube

- Cut off portions both of the drinking straws at 3cm under the bend, and cut 2 cm lengthwise.
- The mouthpiece of the drinking straws points towards the back.
- Push the drinking straws onto the brass tubes up until the bends and attach them to the brass with tape.

Short brass tube

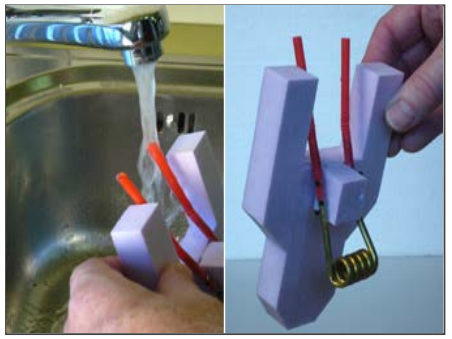
- Seal the bond between the straws and brass tube using tape in order for it to be airproof.

- Fix the tealight candle with two pins on the front of the upright foam block.



Short and long brass tube

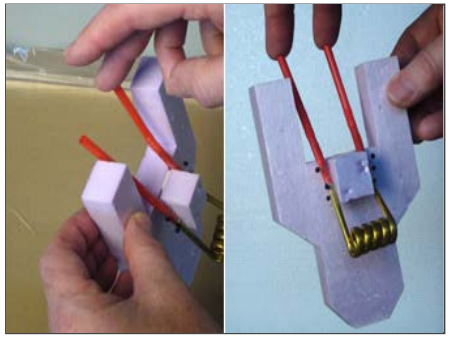
- Attach the brass ring over the candle with two staples on each side of the upright foam block.



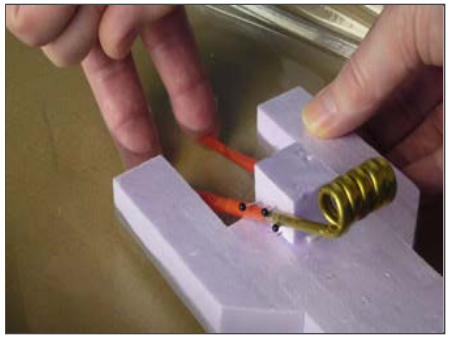
Commissioning the pop-pop boat

- Fill the brass tube with water under the tap.
- Fill until water comes out of the second drinking straw.
- On the way to the water basin, the drinking straws must be held upright.

  No air may get into the openings.

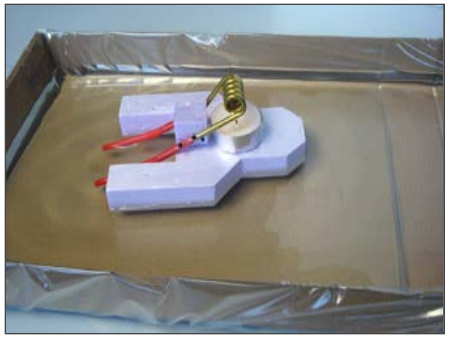


- Close both openings with your fingers before putting the boat in the water.



- Take your fingers away only when the drinking straws are completely in the water.

Safety consideration: The water in the spiral reaches boiling temperature – ca. 100°C. Temperatures as of 65° C can burn you. Never take the boat out of the water before letting the spiral cool down. Filling a hot brass spiral can lead to steam escaping the spiral, which can burn you.



Have fun and patience with the boat's slow advance.

Experiments with the pop-pop boat

explore-it **1st experiment**
Which boat goes furthest?

explore-it **2nd experiment**
Which boat goes fastest?

explore-it **3rd experiment**
How can you determine the direction of your pop-pop steamer boat?

Tip for pouring out the water

- Suspend a drinking straw in the water and siphon on the other side until the water pours out by itself.

Thermal energy

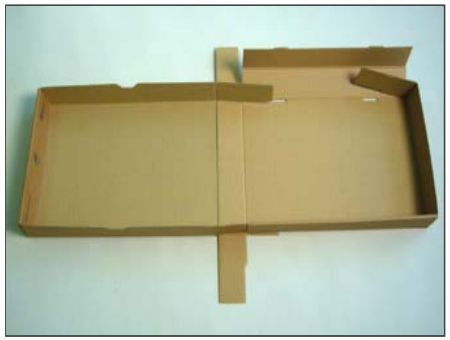
Energy for mobility – ... invent

In this section's Explore tasks you found out already: Temperatures at or above 65°C can burn you. It is dangerous to work with thermally driven motors. This is not only the case for internal combustion engines running on petrol, natural gas, diesel or biogas, but also for tsteam machines. Be extremely careful when you work with these kinds of machines.
Due to the dangers of other thermal energy inventions, we will construct a test basin and invent more machines which however we will not operate.

...invent 1a: Build a simple test basin

You can build a water basin out of the lid and bottom of the cardboard box.

- Open one side of the lid.
- Open all ofthe sides of the bottom.
- Slide the bottom over the open side of the lid.



- Connect the lid and the bottom by folding in the sides of the bottom.

- Put the cardboard basin in the big plastic bag.
- Fill the basin with 2 litres of water.

...invent 1b:
Build a big test basin for the class

In order to not create a flood, you should experiment on the playground. A run with a pop-pop boat is obviously more fun in a bigger basin. It is important that you find a place which is appropriate and flat. That way you will need less water and less investment. All that is needed now is a suitable, thin sheet and a rigid barrier made out of cardboard, wood, etc.

We're looking forward to see your inventions. Photograph, scan or film your test basins and send us the files.

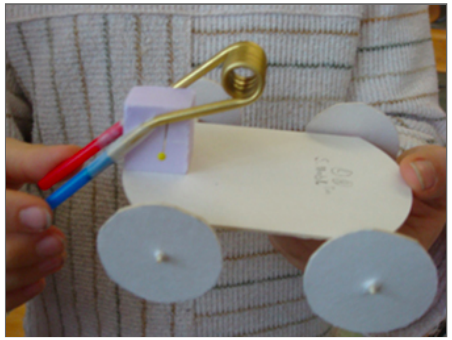
...invent 2: your slick machine

explore-it

Draw your great ideas for a vehicle that goes forward. What does your dream vehicle look like? Can it fly, float, or will you get beamed like the Starship Enterprise? We're not only interested to see how your creation looks like but also how it will move forward. Describe your drawings, sketches and present how it will be powered – you can also make a movie with a mobile phone. Is it a hamster in its wheel or the gas from decomposing food or... , How is it brought forward? Your imagination is requested.

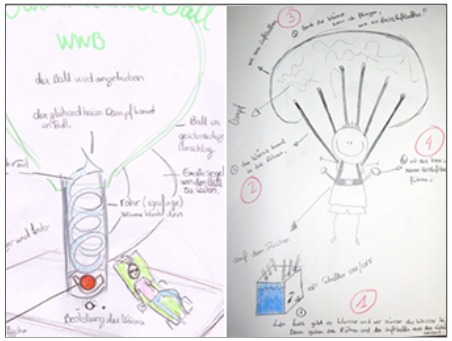
Wärme - Energie, Energie thermique, Energia termica, Thermal energy

... erfinde: Galerie
... invente: Galerie
... inventa: Galleria
... invent: Gallery



Thermischer Antrieb auf Rädern?
Hier hat jemand ein langes schmales Becken unter das Fahrzeug gestellt, das mit Wasser gefüllt ist. Die Räder laufen seitlich davon auf dem Trockenen.

Fahrzeug mit Ei-Antrieb
Auch diese Mädchen aus der Klasse von Heinz Hunziker haben versucht eine Fahrzeug mit thermischer Energie in Bewegung zu bringen. Der Dampf welcher entsteht, wenn im Ei Wasser erhitzt wird, erzeugt einen Rückstoss beim Austritt aus dem Trinkhalm.



Schöner Fliegen

Dampfballon
Der Wasserkocher auf dem Rücken erzeugt Dampf, der den Ballon zum Fliegen bringt.

Portables Becken
Christoph hat ein portables Becken gebaut. Mit den Griffen am Rand kann es transportiert werden.

Thermal energy

Energy for mobility ... and more

... and more: Steam engines - something for the sidelines?

Full steam to the moon?
Rockets too use reaction forces to leave the earth. They do not operate with steam, however..Pop-pop boats are therefore distant relatives of moon rockets.

explore-it

4.1 Task:
Why can we say that a pop-pop boat is a distant relative of the rocket?
How does the pop-pop boat work?
Why does a rocket lift off?

Using sketches and a learning poster, explain how rockets and pop-pop boats work.
Show their commonalities.
Explain the chief difference between rockets and pop-pop boats.
Bonus task: Can the motor from a pop-pop boat be attached to a rocket and flown to the moon?
Give reasons for your answer.

Sources:
Wikipedia: **Pop pop boat**
Sciencetoymakers.org: **How putt putt steam engines work**

explore-it

4.2 Task:
Steam? That's something for the sidelines!
It has been decades since the cessation of routine travel using steam locomotives in Switzerland. Those locomotives were driven to the holding tracks and most of them were scrapped. Only rarely, for example during nostalgia events, it is possible to admire these fascinating giants. These steel colosses are run only on water and fire! Isn't that reason enough to look a bit more into steam!

Answer the following questions using the information in the sources:
How does a steam locomotive or steam engine work?
How fast was the fastest steam locomotive?
Who invented the steam locomotive?
How can we cook using steam?
How can electricity be made from steam?
From where comes the coal which is used for running a steam engine?
Task: Create and a mindmap for each question and display it in your class.

Sources:
Wikipedia: **Steam engine**
Howstuffworks.com: **How Steam Engines Work**
Wikipedia: **Pressure cooking**
Wikipedia: **Denis Papin**
Wikipedia: **Land speed record for rail vehicles (Steam)**
Wikipedia: **Steam locomotive**
Wikipedia: **History of rail transport**
Wikipedia: **Thermal power station**