

# Flying Tea Bag

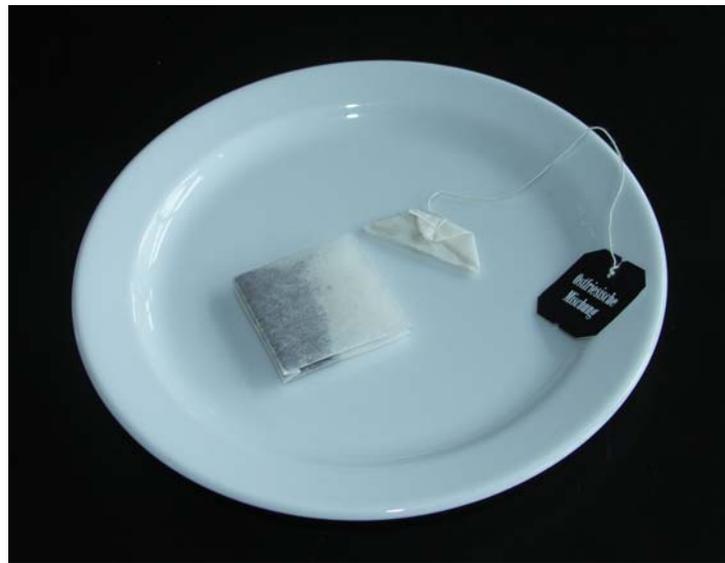
## What you will need

- tea bag
- scissors
- matches
- fire-resistant base (e.g., plate)
- (cup)



## Procedure

1. With the scissors cut off the "head" of the tea bag as straight as possible.

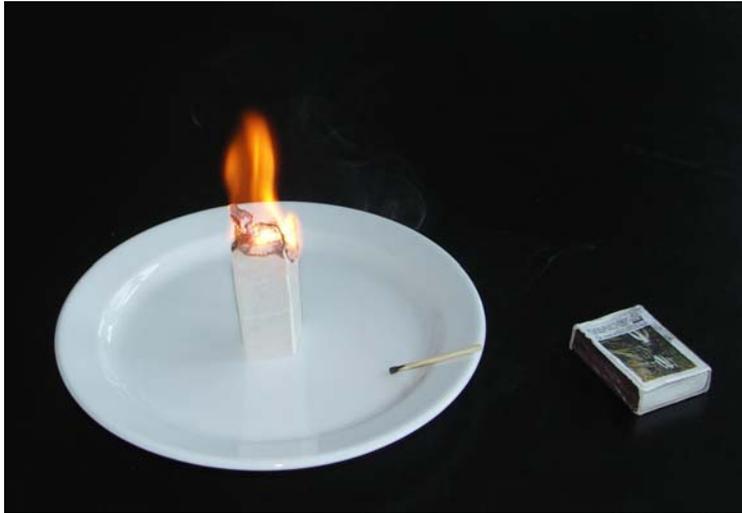


2. Open the tea bag and empty out the tea (can be used separately).
3. Now the tea bag is formed to a tube and is placed upright on the plate.



## Flying Tea Bag

4. Light the paper on the upper side with a match. The tea bag burns itself down slowly and soars into the air after a while.



### How it works

The gases in the surroundings of the tea bag warmed up by the flames rise upwards like in a chimney. They glide along the walls of the tea bag. If the tea bag is burnt down to the half, he is so light that the uprising gases carry him upwards.

### Hints

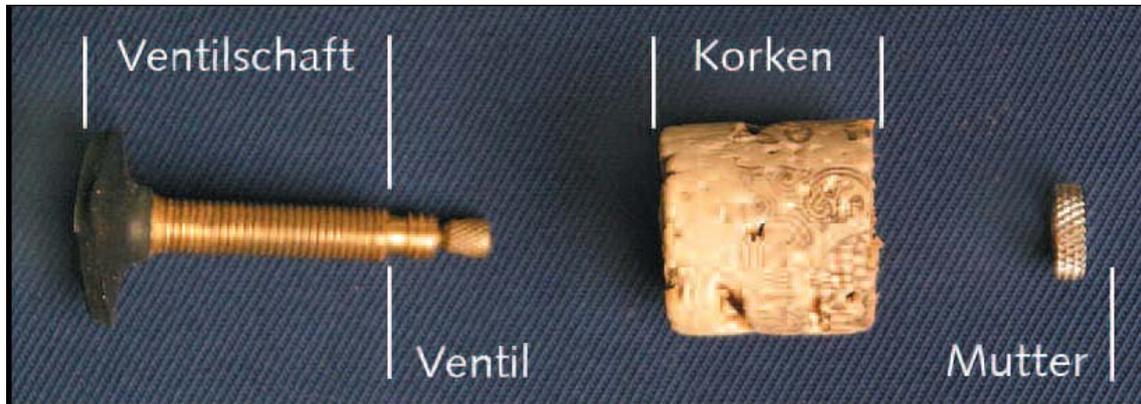
Condition for the success of the experiment is an absolute calm. The cylinder may not fall down before the start.

Some tea bags do not burn very well. Make some tests before an experimental arrangement. Because the tea bag changes at the end into fluff of ash which can leave tenacious stains, try to catch the fluff during the landing with a cup. Most children will have fun with this.

# Waterrocket

## What you will need

- stable 1.5-litre plastic-drink bottle
- old bicycle tube with valve (free of charge a bicycle store)
- air pump with tube
- cork, which fits well on the bottle
- drill
- three rocket wings from cardboard (do handicraft)



## How to build it

1. Cut out the valve from the tube.
2. Drill a suitable hole through the cork and push the valve shaft into the cork.
3. Then put in the valve again (with the nut).
4. Stick three rocket wings outside to the bottle, so that it stands stable on the wings.
5. Fill the bottle to 1/3 with water and close it with the cork.
6. Now inflate the water rocket with the air pump. Is the pressure inside high enough the cork is squeezed out of the bottle and the "rocket" flies away.



## How it works

By pumping in the air the atmospheric pressure within the bottle rises on. If the forces arising by the pressure are so big that the sticking cork is solved, he squeezed out and with him water. During the flight the air in the bottle continues pressing the water out. The water that spouts out as well as the air gives the bottle some upward momentum. After the start the rocket loses more and more of its mass. At the moment where the water is completely squeezed out the rocket reaches his maximum speed and falls to the ground due to the gravitation and its own air resistance.

# Waterrocket

## Hints

- Find a huge start place outside!
- Spectators should keep to a sufficient safe distance during the start!
- Watch out for ricochets!
- Never aim in direction of people!

# Flying Garbage Bag

## What you will need

- very light and big garbage bag
- gas-camping cooker
- lighter
- big piece of cardboard (e.g., wall calendar, poster)
- adhesive tape
- scissors
- (sewing cotton, paper clips)



## Procedure

1. The cardboard is formed to a big tube and is stuck together, so that the tube stands stable (diameter about 35 cm). The garbage bag must easily fit on the tube.
2. Cut out two slits face to face in the lower edge (about 10 cm wide, 5 cm high).
3. The camping cooker is switched on. About the cooker put the tube with the slits down. The slits serve as an aerial supply.
4. Then put the yellow bag on the tube.
5. After a while the yellow bag rises upwards ... and sinks slowly finally.



## How it works

The camping cooker warms up the air within the tube. Warm air has a low density as the cooler air beyond the cylinder and rises up therefore. She fills the garbage bag and carries him upwards. The weight of the bag is so little that the lifting force is sufficient to let him rising up. If the air cools down after a while, the buoyancy decreases and the yellow bag sinks to the ground.

# Flying Garbage Bag

## Hints

The experiment requires absolute calm. So you can arrange everything indoors - in a high room. It is important that the camping cooker stands always concentric in the tube to avoid fire. Perhaps, you can think about a device, so that it is always the case. Because the experiment works with open flames, adults should always supervise it and control the cooker. For an emergency case, always provide a fire extinguisher.

## Variations

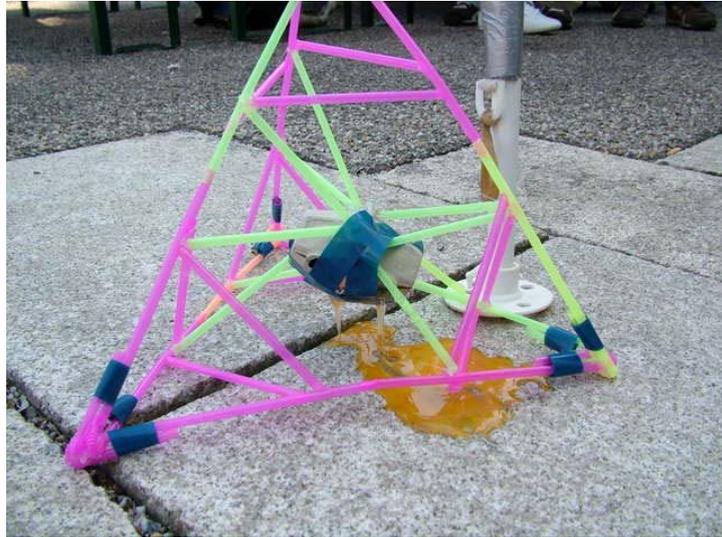
You can stick on weights (paper clips) in the lower edge of the garbage bag - hanging on sewing cotton. This prevents the bag from overturning and gives the bag the appearance of a hot air balloon. Besides, you can test how much weight such a balloon can still carry.



# Crash test for an egg

## Challenge

The problem is to drop an egg from a specified height (about 4 m) and ensure that it remains unharmed. For this you are to build from the available materials a lander which protects the egg from the impact. Similar apparatuses are used in the astronautics to land delicate instruments which must be preserved from the destruction (cameras, measuring instruments) on other planets or moons.



Picture with kind permission of Josef Neuburger, IEEE Student Branch Passau

## What you will need

- raw eggs
- balloons
- drinking straws
- adhesive tape
- cotton woolballs
- polythene bags
- polystyrene drink cups
- paper sheets
- air cushion foil
- scissors
- scale (small scale for the kitchen)

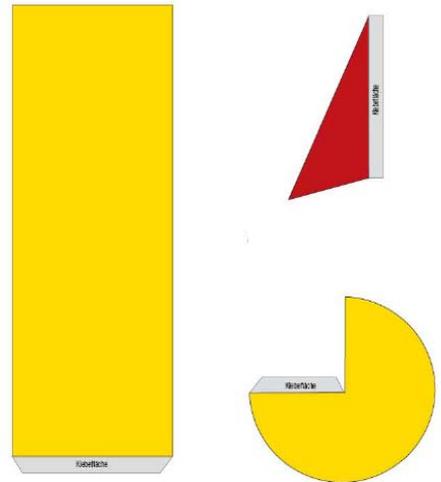
## Procedure

1. At first the teams should consider a model and make a construction sketch. It is important, that each person of the team is involved.
2. Ask them to use as little material as possible for their lander. Also in the astronautics one must think of the weight, because every gramme needs extra fuel.
3. The participants should be able to explain on which mechanism or physical principle the protection of the egg bases (e.g., parachute → enlarged air resistance).
4. Now the models are built and tested.

## Variations

- At the beginning: collecting ideas where in everyday life push-absorbent materials are used (e.g., shock absorber in cars, bicycle helmet, bicycle saddle, shoe soles)
- Ask: Why does the egg generally fall to the earth? What does the drop time depend on?
- Stopping the time of fall during the drops
- Give a landing area.
- Give a maximum size or weight of the model (or permit parachute constructions)
- A jury evaluates the models concerning creativity, effectiveness and functionality

# Film Can Rocket



Picture and illustration with kind permission of KONTEXIS

## What you will need

- empty film can (only with “click lid”!)
- soft drink-/vitamin tablets
- Water

for the paper version add:

- glue
- scissors
- coloured paper

## How to build it

1. fill the film can to a quarter with water. Then throw in a half tablet and closes the can very quickly.
2. Put the rocket with the lid down to a place with high ceiling (3 to 4 m).
3. After some seconds the upper canned part shoots upwards.
4. You can give to the film can the appearance of a rocket by handicrafts a little: cut out a rocket cover, a rocket head and 3 wings and stick them to the rocket after folding.

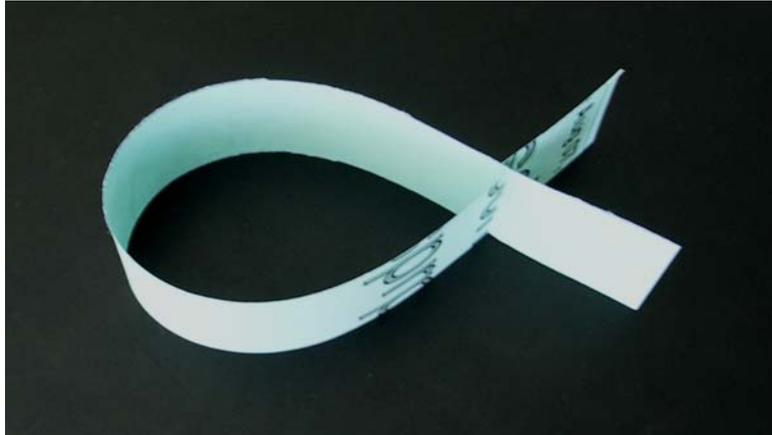
## How it works

If you throw the tablet in the water, a gas (carbon dioxide) whose volume is much bigger than that of the tablet originates. Because the film can is closed, the pressure rises inside so long, until the lid of the originating strength cannot stand firm any more. Because the lid stands on the ground, the body of the can flung upwards.

## Hints

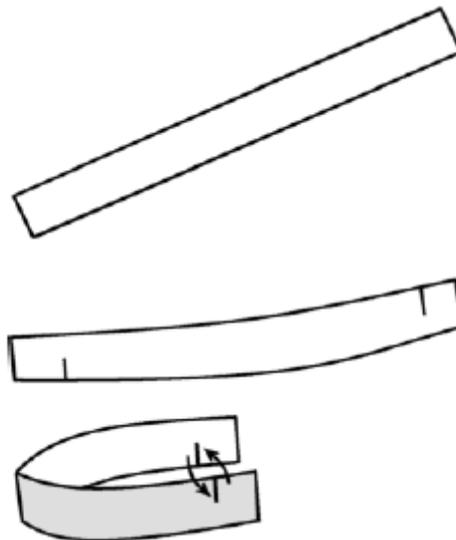
During the start always viscous water sprays. Therefore, pay attention to a suitable base.

# Flying Fish



## What you will need

- 1 sheet of paper
- scissors
- perhaps ruler and pencil



Illustrations with kind permission of K.P. Kostian

## How to build it

1. Cut out a narrow stripe of the sheet of paper (dimensions are not very important).
2. Before the ends cut stripe - once on top and once below - up to the half.
3. Put both slits into each other, so that a form arises which reminds of a fish.

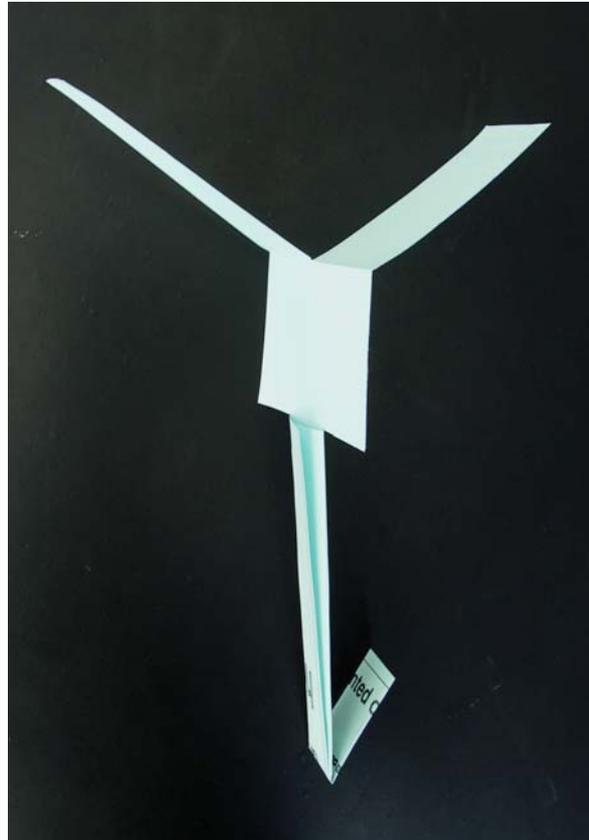
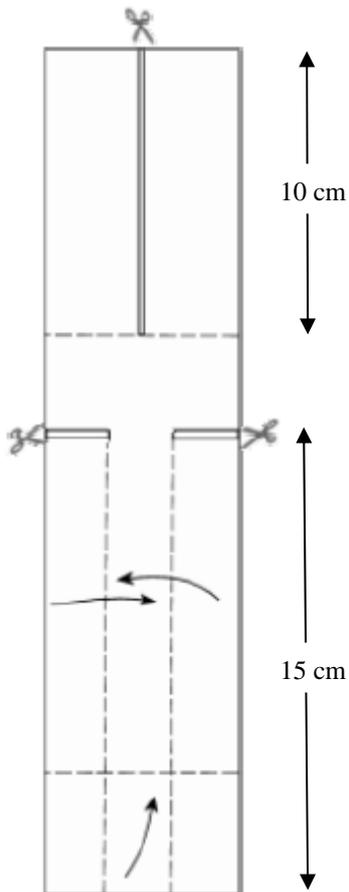
## Start

The flying fish is simply dropped from big height. After a while he starts to rotate around his long axis.

# Helicopter

## What you will need

- 1 sheet of paper (DIN A4)
- ruler
- pencil
- scissors



Illustrations with kind permission of K.P. Kostian

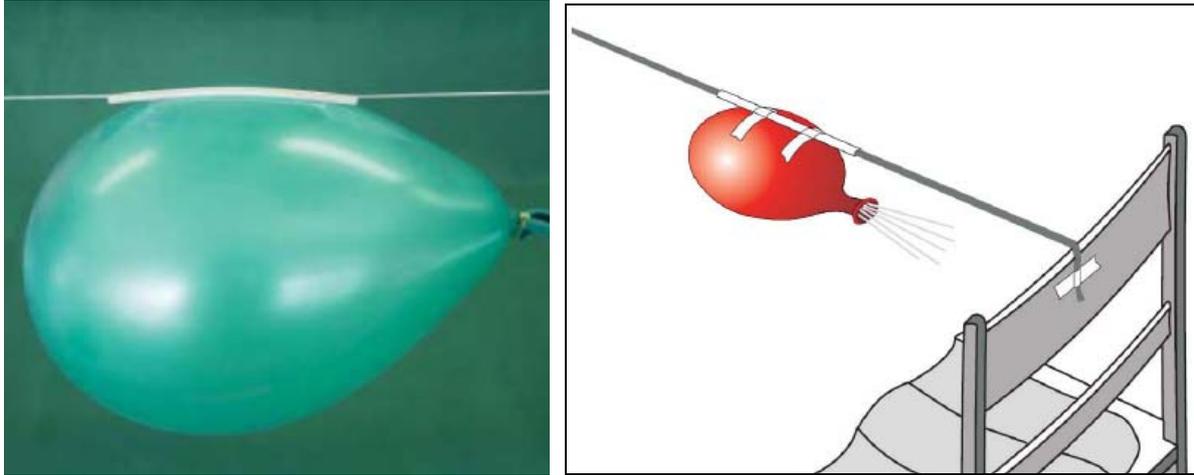
## How to build it

1. Cut out a rectangle with the dimensions 30 x 7 cm.
2. Cut the paper in the solid line; fold it in the dotted line (follow arrows).
3. One air-screw is folded forwards, the other to the back.

## Start

The helicopter is simply dropped from big height.

# Balloon Rocket



Picture and illustration with kind permission of KONTEXIS

## What you will need

- balloon
- thick drinking straw
- adhesive tape
- thick fishing line (10 m)
- clothes peg
- scissors

## How to build it

1. Put the fishing line through the drinking straw.
2. The balloon is inflated, the oral piece is snapped and closed with the clothes peg.
3. Then stick the drinking straw with one (or two) pieces of tape at the balloon.
4. Stretch the fishing line tightly. If you release the opening of the aerial balloon, he flies like a rocket along the string.

## How it works

Air escapes at the oral piece of the balloon under high speed. This causes a recoil, so that the balloon moves into the opposite direction of the outstreaming air.

## Hints

Do not use drinking straws with a hinge. If, nevertheless, this part must be cut off before. Instead of fishing line any other thin string is also usable. But to hold the friction as low as possible, a smooth material is recommended.

No bend is allowed while sticking the drinking straw on the balloon.

It is interesting to try out different balloon forms (e.g., long narrow balloons)

The flying range depends on the used materials, however, amounts about 5 m.

# Air Rocket



Picture and illustration with kind permission of KONTEXIS



## What you will need

- soft plastic bottle
- 2 drinking straws: a thick and a thinner one
- drill
- plasticine
- glue
- paper

## How to build it

1. Pierce the cap of the plastic bottle. The hole must be so big that the thin drinking straw sits tightly in it. Seale the contact places with glue.
2. Shorten the thick drinking straw ("the rocket") at about 10-cm length. At one end one attach some plasticine, stick small tail units from paper to the other end.
3. Now the rocket is pushed about the thin drinking straw ("the start ramp").
4. If you squeeze the bottle quickly, it will fly away several metres.

## How it works

By the quick compression of the plastic bottle the air inside is under a higher pressure for a short time, which causes forces on the inner surface. Because the rocket is the only movable part of the system, it is pushed away. Besides, air escapes from the container.