ROCKET MODEL – WATER AND AIR PROPULSION

MED 08.12

Material

Item-no.	Qty.	Description
DM340-5A	1	Rocket - model

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Purpose
To demonstrate the model of a water rocket that accelerates from 0 to 100 km per hour in 0.3 seconds.

First assembly of the rocket model

The rubber sleeve is pressed into the screw cap.
The inner edge of the plastic ring must snap into the groove of the rubber sleeve.

The rubber O - ring is placed in the groove around the rubber sleeve. The ring should be pressed in up to the front of the screw cap; a thin spatula can be used for this.

The hose of the pump and the hose of the rocket model are screwed tightly together.

The metal sleeve of the hose is pressed into the rubber sleeve. This requires some force.

Please do not grease or oil!

This would make it easier to press in the metal sleeve, but the sleeve would also be thrown out much sooner in the experiment.

Insert the wings of the rocket into the sleeves on the plastic ring.

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Experiment
One third of the plastic bottle is filled with water and screwed onto the launching unit.

The start should take place outdoors on a sufficiently large area depending on the wind direction, wind strength and launch angle.

Air is now pumped into the bottle with the pump, this builds up excess pressure in the "rocket body".

Result

If the pressure is high enough, the metal sleeve and hose are thrown out of the rubber sleeve.

The rocket ascends.

When the rocket returns (=falling) it is very light and hardly damaged on impact.

Note
It is interesting to experiment with different fill quantities.
If there is too much water in the rocket body the propulsion force - at the same pressure - is not sufficient to launch the rocket and if the rocket becomes lighter there is a great lack of pressure from the partially relaxed air.
Great acceleration is achieved with very little water however the duration of the drive is short.

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Experiment with Video-Analysis
This experiment can be evaluated quantitatively with our video analysis software.

To do this simply place a 1-meter ruler directly in front of the rocket.

Now the screen is scaled and you will receive quantitatively correct results.

A quadratic relationship for the covered distance is assumed, i.e. $s = ½ * a * t^2$. The acceleration is constant in this case.

After evaluating the flight curve, it then amounts to $95 m / s^2 = 9.7 * 9.81 m / s^2 = 9.7 * g$, which is almost 10 times the acceleration due to gravity.

An astronaut experiences about 4g when fired with the Saturn V or Soyuz rocket. For comparison: a Formula 1 car needs about 2 seconds to reach 100 km / h, a Bugatti Veyron with 1001 horse power does it in 2.5 seconds.

Since the accelerations are not constant here the a-values are not comparable.

Our rocket reaches 100 km / h in about 0.3 seconds - a normal car needs about 7 to 10 seconds.

The rocket will not be able to maintain this constant acceleration for very long, the pressure inside will drop. For the first half or whole second it’s OK to look at it like that.
This phase of the flight is most impressive for us and the students.

At some point the rocket (bottle) will fall to the ground again.