



Rufus and the racers

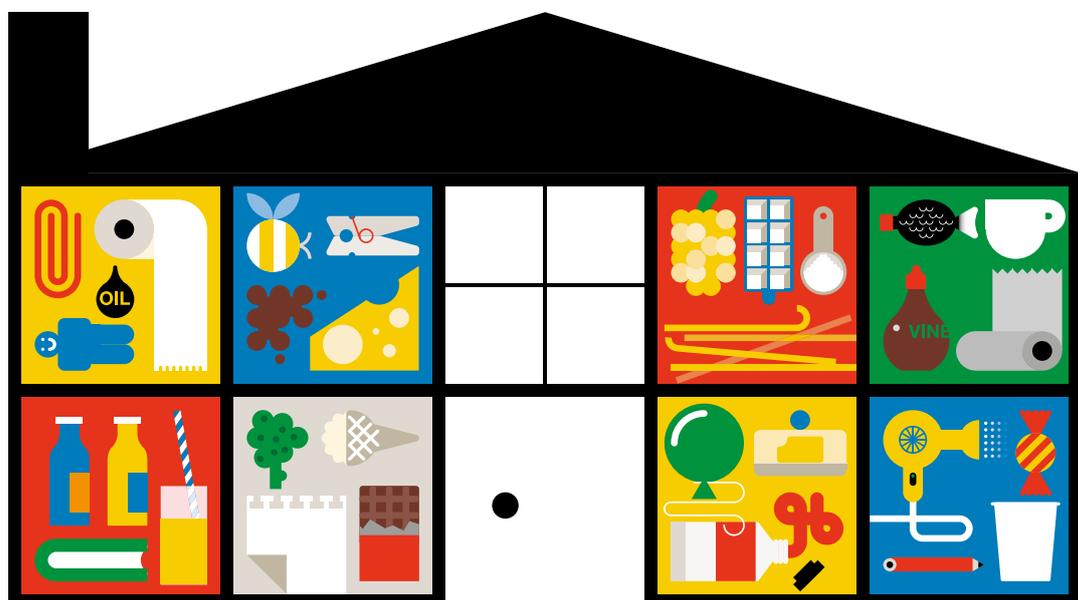
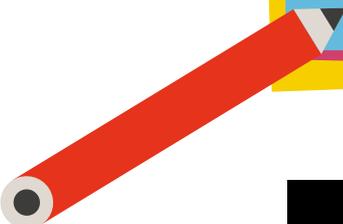


The activity

Make boats that race across water, powered by soap.

ExpeRiment with different liquids to see if they produce the same effect.

Learn how soap affects the way water molecules hold onto each other.





What you'll need

Special materials

You can cut your boat out of an empty juice carton or plastic milk bottle by hand or you can download our template at the end of this info sheet.



- Washing up liquid
- Dried oregano or chilli flakes or coarsely ground black pepper
- Shallow dish / plate with a lip
- Range of household liquids, for example: vinegar, milk, cooking oil, liquid hand soap, shampoo, conditioner, soy sauce
- Ice cube tray
- An empty juice carton or plastic milk bottle
- Cotton buds
- Baking tray

What to do

Investigating the effect of different liquids the surface of water

Prepare an ice-cube tray with a little amount of different household liquids in each compartment. You don't need to fill the compartments as you'll only need a tiny bit of each liquid.

Put some water into a shallow dish or plate. Sprinkle the water with the oregano flakes or pepper.

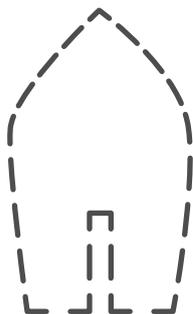
Dip one end of a cotton bud into some washing up liquid and then dip this into the water in the middle of the plate.

Clean the plate and try repeating this experiment using different liquids to dip the cotton bud in. See if liquids other than washing up liquid have the same effect.

Making soap powered boats

Take an empty juice carton or milk bottle and cut out a piece that is a bit bigger than the size of boat you want to make (we suggest a length of about 2 to 4 cm at most). Draw this shape (left) onto it and cut it out.

Alternatively, print out our template, stick it on the **outside** of the juice carton or plastic milk bottle and cut it out.



Continues >>



What to do (continued)

Fill a baking tray with water.

Place the boat onto the surface of water in the baking tray.

Dip a cotton bud into washing up liquid and touch that into the water in the gap at the back of the boat.

Change the water in the baking tray once the boat no longer moves.

Questions to ask children

Being safe

There are no specific risks with this activity but we always recommend that you use common sense and take general care, for example, avoid getting soap into eyes.

Before dipping cotton bud with washing up liquid into water with oregano: what do you think will happen? Why?

Why do you think that happened?

What do you think will happen if we use liquids other than washing up liquid?

Do you think this hand soap will be as good as the washing up liquid? Why?

Do you think this hair conditioner will work? (What is hair conditioner used for?)

What about cooking oil?

After trying out different liquids: what do you think the liquids which make this work have in common?

What other experiments could we try?

Before adding soap to the boat: what do you think will happen when we touch washing up liquid to the back of the boat? Why?

The science

The surface of water is a bit like the surface of an inflated balloon. In a balloon, every bit of the rubber is pulling on the bits around it. The surface of water is similar because every molecule is pulling on every other molecule around it.

If you stick a pin in a balloon, the rubber pulls away from that point. Something similar happens when you put soap on the surface of water. The soap has the effect of weakening the

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The science

pull that water molecules have on each other, and so as the soap spreads out on the surface, the water pulls away, and in doing so takes the oregano or pepper with it.

With the boats, putting soap into the hole at the back of the boat forces water out of the hole. The water moving out of the back of the boat is what pushes the boat forward, just as the hot gases coming out of the bottom of a rocket push it upwards.

Lots of things work like this. For example, when a bird flaps its wings, it presses downwards on the air, this makes the bird go upwards.

You can't fly because your arms aren't like wings and you are too heavy. But you may be able to swim. If you do the breast stroke, your arms push the water backwards and that's what makes you move forwards. In the case of the soap powered boats, the water is pushed backwards by the addition of soap to the hole at the back of the boat.



Going further

Fill a glass absolutely full with water. Gently slide a paperclip onto the surface of the water – you should be able to make it float like in this video:

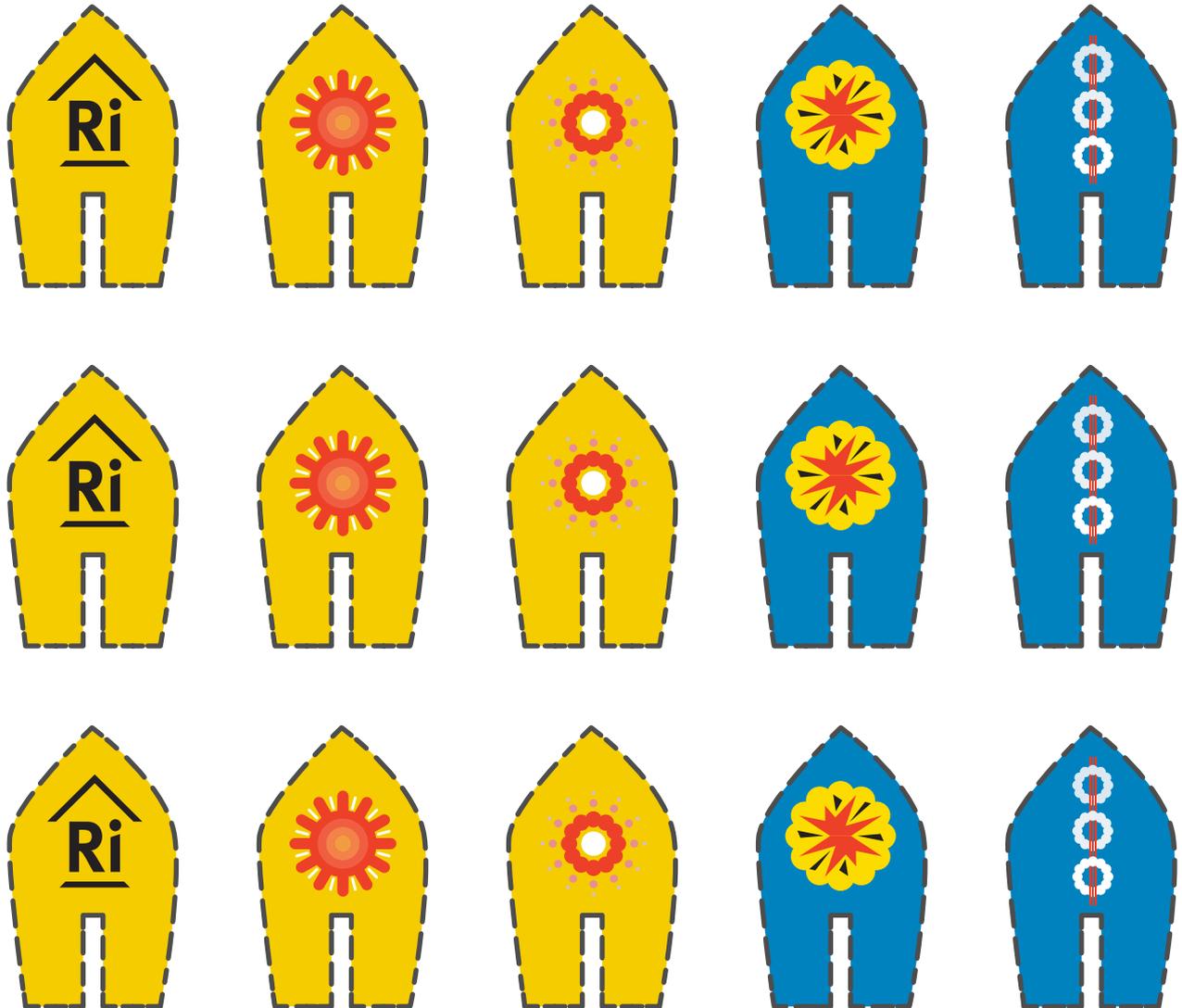
<http://bit.ly/FloatingPaperclip>

Now, can you think of a way of making the paperclip sink without touching it?

Learn about the science of 'Marangoni Effect' and how it's related to soap boat racers <http://bit.ly/MarangoniEffect>

How many drops of water can you fit on a penny? Try putting water onto a penny, one drop at a time and see if you can predict how many will fit, like in this video: <http://bit.ly/WaterPenny>

Alternatively, see how many pennies you can fit into a full glass of water: <http://bit.ly/PennyWater>



Print out this page and cut out your favourite boat. Stick it onto the **outside** of a juice carton or plastic milk bottle and cut it out.

Fill a baking tray with water.

Place the boat onto the surface of water in the baking tray.

Dip a cotton bud into washing up liquid and touch that into the water in the gap at the back of the boat.

Change the water in the baking tray once the boat no longer moves.