

# FIZZY BOATS

What is powering the boat's motion?

Why does the boat eventually stop still?



Can you explain the findings?

Equipment required:

Plastic bottle

Coloured paper

Scissors

Straw

Tape

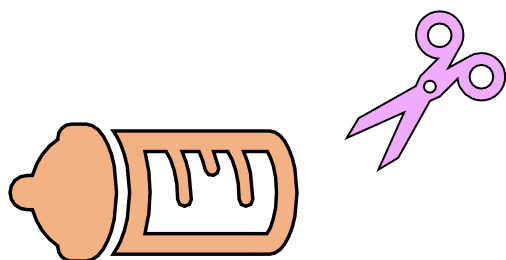
Large tub

Water

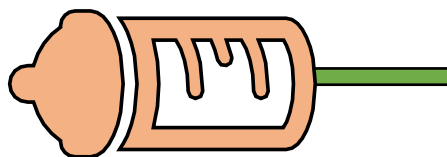
Vinegar

Baking soda

- 1** With the help of an adult, cut a hole in a plastic bottle.



- 2** Put a straw through the hole and seal around the straw with tape.



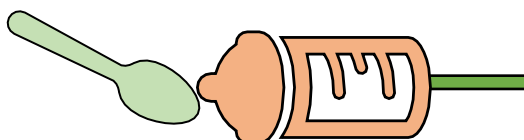
- 3** Fill a large tub with water.



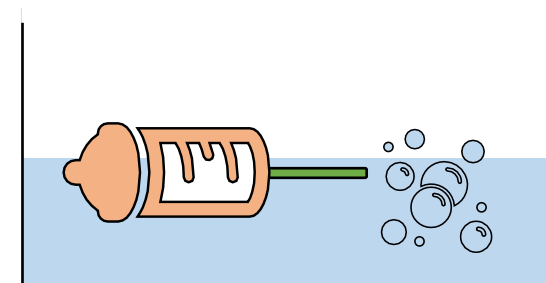
- 4** Carefully pour some vinegar into the bottle.



- 5** Carefully spoon in some baking powder so it does not yet mix with the vinegar.



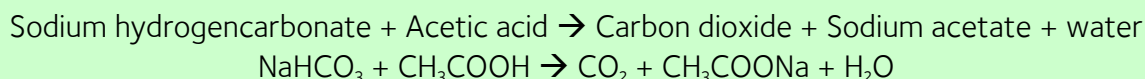
- 6** Put lid on bottle, mix powder and vinegar, and place in water.



## The science behind the scenes...

Mixing baking soda (sodium hydrogencarbonate,  $\text{NaHCO}_3$ ) and vinegar (ethanoic acid,  $\text{CH}_3\text{COOH}$ ) results in a **chemical reaction**. Vinegar is an **acid**, and baking soda is a **basic** substance, so they react together to produce a **gas**, carbon dioxide ( $\text{CO}_2$ ).

The reaction:



The gas powers the boat's motion. When it is produced, it is propelled out of the bottle via the straw as its production increases the pressure inside the bottle, so it wants to escape to fill a larger container (the outside)!

## Practical investigation:

### Equipment:

- |   |                                    |                                      |
|---|------------------------------------|--------------------------------------|
| <input type="checkbox"/> Plastic bottle | <input type="checkbox"/> Tape      | <input type="checkbox"/> Vinegar     |
| <input type="checkbox"/> Scissors       | <input type="checkbox"/> Large tub | <input type="checkbox"/> Baking soda |
| <input type="checkbox"/> Straw          | <input type="checkbox"/> Water     |                                      |

### Method:

1. With the help of an adult, cut a hole in the plastic bottle using scissors for the straw to insert in.
2. Add decoration to your bottle to make into a boat, i.e. using paper.
3. Place the straw in the hole, and seal the gaps around the straw using tape to keep the straw in place. Ensure the straw remains open to allow the gas to escape and power our boat!



4. Fill a large tub with water.

5. Add vinegar carefully into plastic bottle, tilting the bottle so that the straw points upwards and the vinegar does not leak out the straw when poured in.



6. Carefully spoon the baking powder into the bottle so that the soda and vinegar do not mix yet.



7. Place the cap back onto the bottle, and allow the soda and vinegar to mix. Immediately place the bottle in the water and watch the boat go!

### Questions...

- (a) What is powering the boat? [Carbon dioxide gas is produced by the reaction between vinegar and baking soda and this is released, powering the boat]
- (b) Why does the boat eventually stop moving? [all the vinegar and baking powder has reacted so no more gas is being produced]

### Science isn't just useful in the lab...

Ever wondered how ships, which are so huge, actually stay afloat? Ships are made from **metal**, which is more dense than water. However, they are not made out of solid metal, they are instead **hollow** (have empty space inside). This means they have lots of **air** inside them. Air is much less dense than water, and it is this air which allows a ship to float! A ship sinks when water enters the boat in place of the air. The sinking of the Titanic in 1912 is a famous example. The ship hit an iceberg which tore small holes in the ship. Water entered the ship through these holes, forcing the air out and untimely causing the ship to sink.

So- once again, **density** has proven to be a fundamental concept of science (you can explore density further with our 'Float and Sink' and 'Magic Rainbow' At Home activities!)

