

Forces on water rockets

The NPL Water Rocket Challenge is to land a rocket at a range of $70\text{ m} \pm 5\text{ m}$



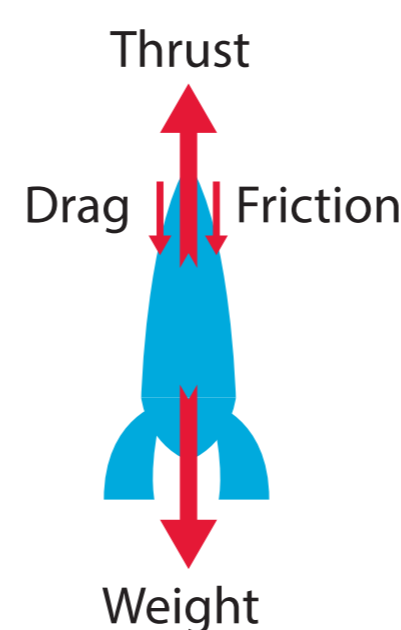
Forces on the rocket

Friction in the launcher can slow launch.

Thrust is the push from water and air leaving the rocket, propelling it forwards.

Weight is the force on the rocket due to Earth's gravity.

Air resistance (drag) slows the rocket down.



1

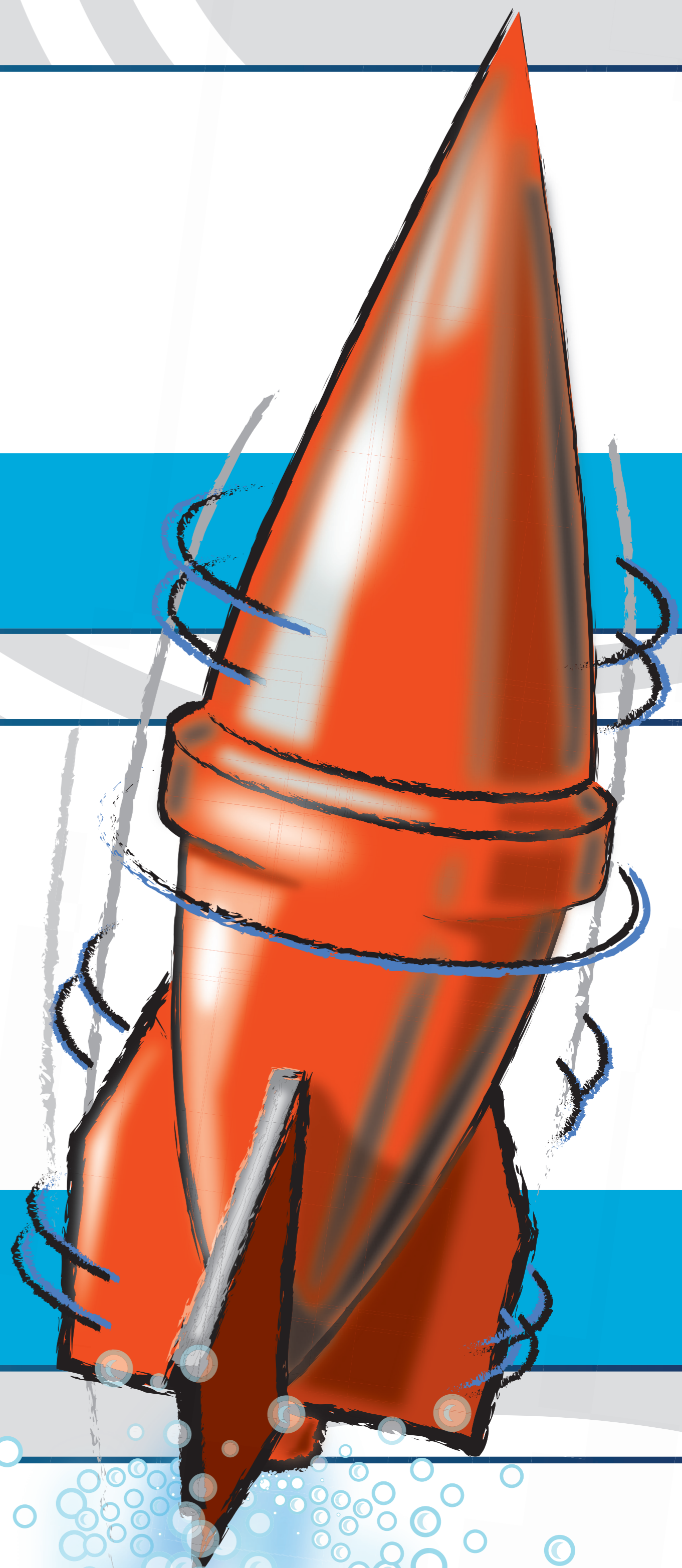
Which directions do these forces act in, and how do these directions change during flight? (Maybe this gives you a clue about why aeroplanes need wings.)

Thrust

The rocket forces propellant (gas/liquid) backwards and an equal and opposite force pushes the rocket forwards.

The amount of thrust is influenced by the rate at which water leaves the bottle and depends on:

- Pressure: the higher the pressure the faster the water leaves.
- Nozzle design: bigger nozzles with streamlined necks allow water to leave the bottle more easily.



2

If you spray a hose-pipe while sitting on a skateboard, will you move?

Pressure

The 'bar' is a unit measuring air pressure (1 bar is about 1 kg/cm^2).

A reading of 1 bar means an additional bottle's worth of air is squeezed in, etc.

Higher pressure means more stored energy.

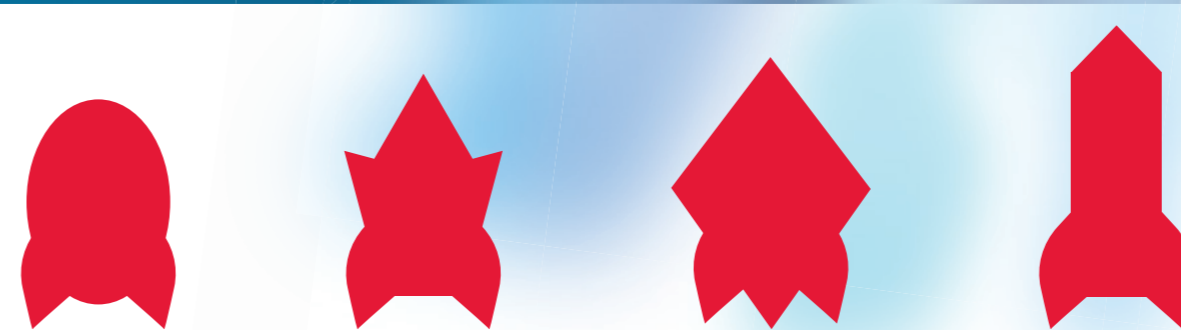
Fizzy drinks bottles explode beyond 7 bar.

3

1 kg/cm^2 is about the pressure of an elephant on the ground. Why would we notice an elephant standing on us, but we don't notice the air?

Shape

Which rocket do you think will go the furthest and why?



Did you know?

The National Physical Laboratory (NPL) hosts the longest-running water rocket competition in the world and has also built the world's largest water rocket.

Check out npl.co.uk/wrc



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