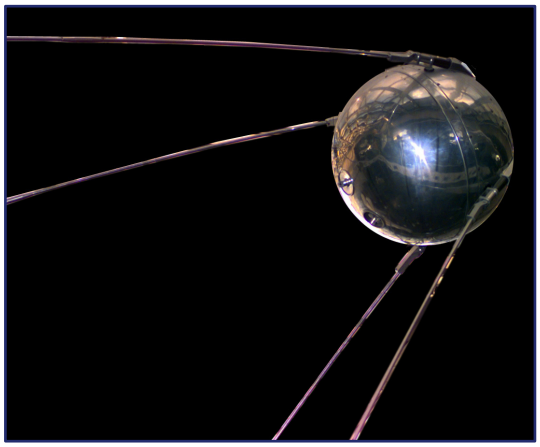
Destination Space
Beyond the Visible Universe

Activity Pack 2 – Rockets

Please watch video 2 – 'Rockets!'.

Webb will use a rocket to get into space, and the activities below will get your learners considering the science and engineering behind rockets by building and launching their own.

The first rocket to launch something into orbit was the Soviet R-7 rocket which launched the Sputnik satellite in 1957. Since then, rockets have become integral to space travel, carrying humans to the Moon, launching thousands of satellites and enabling the exploration of distant planets.



Sputnik 1 – the first human made object in orbit around the Earth

The European Space Agency Ariane 5 rocket – the same type of rocket that will be used to launch Webb from French Guiana

Rocket engines work by burning huge amounts of fuel. The burning fuel produces gas, known as propellant, which is expelled through the rocket's exhaust. In space, there is nothing for the rocket engine to 'push' against. Instead, the rocket pushes against the propellant and the propellant in turn pushes the rocket forward. The underlying physics of this was originally put forward by Isaac Newton (hundreds of years before the first space rocket!) who stated in his Third Law of Motion: *for every action there is an equal and opposite reaction*.

Below are three different rocket craft suggestions, each with different resource requirements. One of these activities would be sufficient, however attempting several can lead to interesting discussions about the differences between each rocket design and why some fly further than others, for example.

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Activity Idea 1 – Straw Rockets

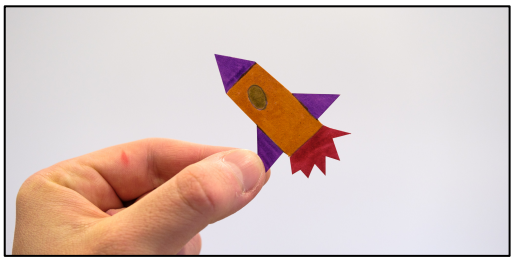
Resources

- Empty plastic bottle with a sports cap
- Cardboard
- 2 straws – one wider than the other
- Scissors
- Glue or Sellotape
- Blu Tack or Plasticine
- Colouring pens/pencils for decorating

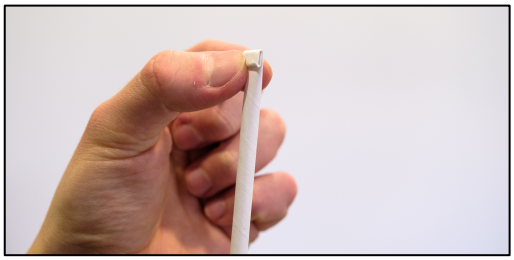
Instructions

1. Bottle launching device: Lift up the sports cap and push in the thinner straw about halfway. Seal around the straw and sports cap with Blu Tack or plasticine. Squeeze the bottle and make sure air is coming out the top of the straw only.

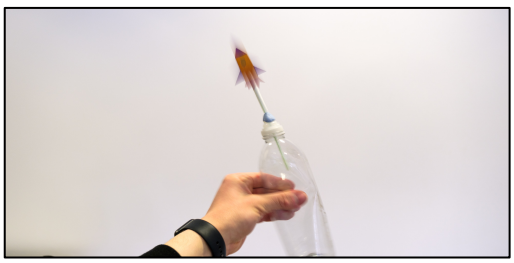
2. Straw rocket: Draw and cut out a cardboard or paper rocket. This can be any shape or design you want. Make sure it is not too big to be attached to the end of a straw. Decorate it however you like.



3. Fold the top of the wider straw over several times and seal using Sellotape. This straw must fit over the top of your thinner straw. Blow down the straw and make sure no air can escape from the top.



4. Attach the card or paper rocket onto the sealed end of the wider straw with glue or Sellotape. You are now ready to launch! Place the rocket onto the bottle launcher and squeeze the bottle hard to launch.



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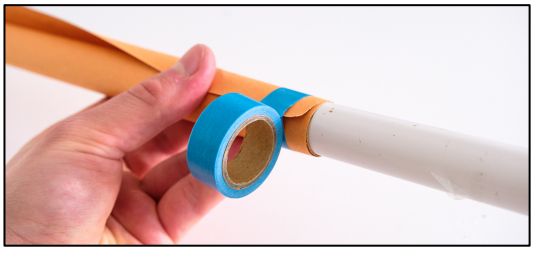
Activity Idea 2 – Stomp Rockets

Resources

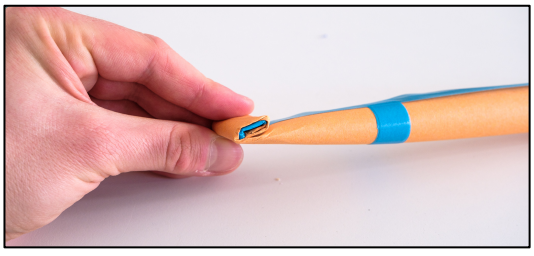
- Thick paper or card (1 sheet per learner)
- Foam sheet (optional)
- Scissors
- Sellotape
- Colouring pens/pencils
- Materials for decorating (optional)
- Stomp rocket launcher (e.g. https://www.tts-group.co.uk/junior-stomp-rocket/1003958.html)
- 21.5mm diameter pipe (e.g. https://www.diy.com/departments/floplast-white-waste-pipe-bend-dia-21-5mm/152673_BQ.prd) for use as construction guide

Instructions

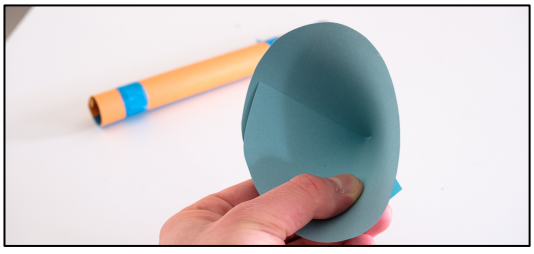
1. Roll the piece of paper around the plastic pipe to make a tube shaped rocket body. It should fit snugly on the pipe, but not be too tight. If pipe not available, you can use the stomp rocket launcher itself as the diameter guide.



2. Fold the top of the body of the rocket over several times and tape down securely to make it air tight. Blow down the tube to check no air can escape.



3. Make a cone for the top of your rocket. This can be achieved by cutting a circle and making a single cut from the edge to the centre. Sellotape the cone to the closed end of the rocket body.



4. Make tail fins for your rocket out of foam sheet or card. You can experiment with the size, number and shape of these, but remember they will affect how streamlined your rocket is and how far it will go.

Extension Tasks

You could use your rockets for a simple maths activity. Launch your rocket horizontally, time how long it is in the air for, then measure the distance it travelled.
It is then possible to calculate the rocket's average speed using the equation:

$$speed = distance \div time$$

Experiment with making the rockets different shapes and sizes. Change the designs of the fins or even the material they are made out of. How does this affect how well they fly? Why might this be the case?

Activity Idea 3 – Canister Rockets

Resources

- Empty 35mm plastic film canisters with lids. The clear ones are preferable (e.g. https://www.amazon.co.uk/dp/B077SXXDMJ/)
- Fizzing (effervescent) tablets, such as Vitamin C tablets
- Water in jug
- Safety goggles (1 pair per learner)

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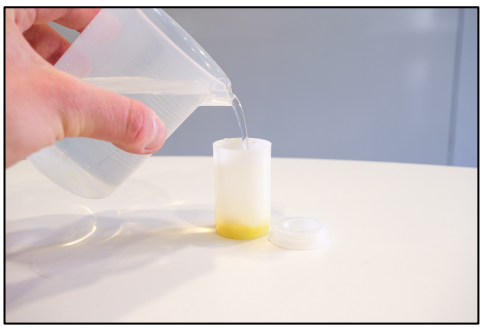
Instructions

1. Put on the safety goggles and head either outside or somewhere with an easy-to-clean floor.



2. Break the effervescent tablets into quarters or half and place one small piece in the film canister.

3. Quarter fill the canister with water, quickly snap the cap on (ensuring it is properly sealed), give it a quick shake, and put the canister on the ground cap side down.

4. Stand back! After 5-10 seconds, you will hear a pop and the canister will launch into the air.

Extension Tasks

It is possible to turn the canister rocket activity into an experiment where participants explore the effects of changing different variables, for example:

1. Does water temperature affect how fast the rocket launches?
2. Does the size of the tablet piece affect how long it takes the rocket to launch?
3. Does adding a paper nose cone to the canister allow it to fly higher?
4. How much water in the canister is best?
5. Can the flight path be controlled by adding cardboard fins to the canister?

Many of these experiment ideas would work well as a maths activity, for example: create a table of water quantity and rocket height, take several readings for each quantity of water, calculate the mean height for each water amount, plot a graph of flight height vs. water quantity etc.