Discover Primary Science and Maths
www.primaryscience.ie

# DESIGN AND MAKE A PAPER ROCKET

BASED ON AN ACTIVITY FROM THE INTERNATIONAL SPACE STATION (ISS) EDUCATION KIT

## Learning Objective

"The child should be enabled to become aware of and explore how .... moving air can make things move"

*(SESE: Science Curriculum page 45).*

**Strand: Energy and Forces. Strand Unit: Forces**

## Equipment

A4 sheet of paper, straw (wide diameter if possible), scissors, pencil (of approximately the same diameter as the straw), sellotape and measuring tape.





## Suggested Class Level

**Middle and Senior**

(some of the Middle children may need help, especially starting rolling the paper at the correct angle round the pencil).

## Preparation

**Collection of materials.**

This activity can be designed and made in the classroom, but a larger space such as the school hall, or outdoors on a still day, would be desirable for launching the rockets.

A starting point should be marked out for the launching.

## Background information

*(Technically the paper rocket is a rocket in appearance only.*

*Real rockets get their energy from burning fuels emitting gases from the back of them, which send them forwards. See DPSM activities 'Rocket Launch' and 'Make a Rocket' which are based more on the principle of real rockets).*

Moving air can move many things. A light breeze can move leaves on trees, while a hurricane can cause great damage to buildings and even blow ships onto rocks. Electricity is made on wind farms from moving air. Sailing ships rely on moving air to drive them.
(See DPSM Junior activity *'Moving Air'*).

(Trapped air can also have a good deal of power.
See under 'Pneumatics' in *'Air and Water Power'* Activity).



# DESIGN AND MAKE A PAPER ROCKET

## Trigger questions

What is the hardest part about going into space?
*(Getting off the ground!).*

Why is this?
*(The strong pull of Earth's gravity brings things back to the ground).*

So how does something huge and heavy like a spacecraft manage to break away from Earth's gravity?
*(A powerful rocket blasts it into space).*

What is a rocket?
*(A cylinder full of materials which produce gases).*

How does it work?
*(Gases going out the back of the rocket push it forward, like an untied blown-up balloon goes forward when you let it go while the air goes out the back).*

Where do these gases come from?
*(From burning fuel).*

For something to burn what do you need?
*(Air/oxygen)*

But there is no air in Space! So how do the fuels burn?
*(Rockets carry their own oxygen with them).*

## Content

**Science:**

Forces

**Maths:**

Number: Operations (averages)

Measures: Length

Shape and Space: 2-D shapes (circle), 3-D shapes (cone), Lines and Angles

Data: Representing and Interpreting

## Skills

Investigating (Fair Testing)

Estimating and Measuring

Designing and Making, Recording, Analysing

## Cross-curricular links

Geography: Planet Earth in Space

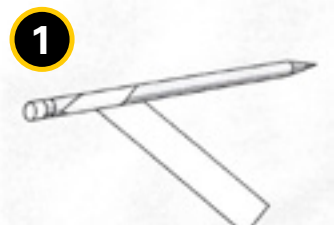
Art: Rocket Design

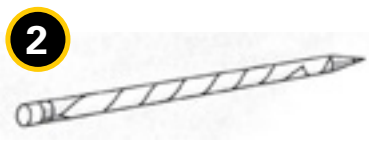
## Activity

Children should be encouraged to Design and Make their own rocket, given the above materials. One possible suggestion is as follows:

Cut a strip, 5 cm. wide, from the long side of an A4 sheet of paper. Then:

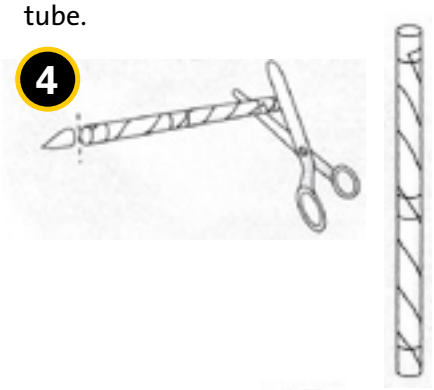
1. Starting at one end of the pencil, hold the paper at an angle of approximately 45° to the pencil.
2. Roll the paper strip around the pencil fairly tightly until you get to the other end.
3. Tape the tube at each end and at the middle of the rocket.



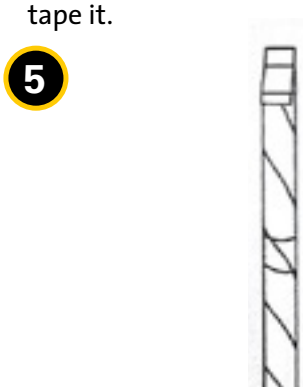




# DESIGN AND MAKE A PAPER ROCKET

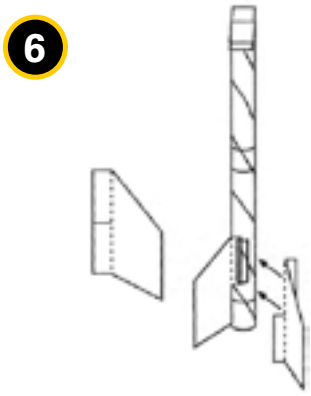
4. Cut off both ends of the tube.



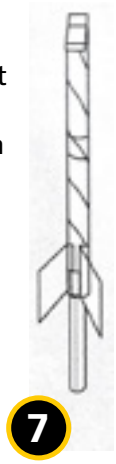

5. Fold the upper end firmly and tape it.



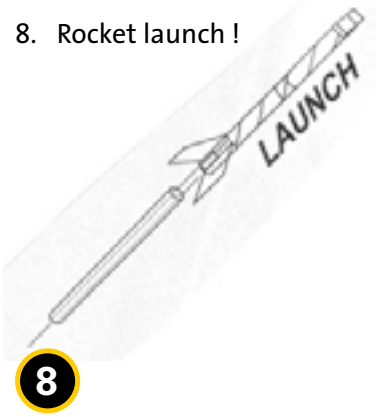

6. Design the rocket's nose* and fins.



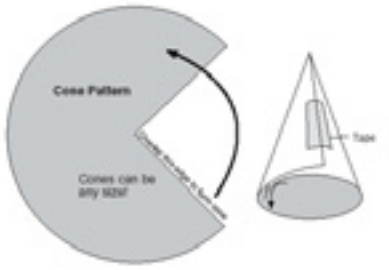

7. Launch the rocket by inserting the straw in the open end and blow.




8. Rocket launch !




*One possible way of making a nose cone is as follows: draw and cut out a circle, then remove a segment from the circle. Overlap the straight edges and tape down.




Can they make a cone from a quarter of a circular disc?

## Maths

- The children should predict how far their rocket will go.
- What instrument will they choose to measure the actual distance?
- How will they decide what to measure in order to make it a fair test? (i.e. they need to decide what part of the rocket is being used for the measurement, so that it is the same for everybody)
- They should launch their rockets a number of times, firstly estimating the distances travelled , and then measuring them and taking the average distance.

| DISTANCE TRAVELLED (cm) | | | |
|---|---|---|---|
| 1st go | 2nd go | 3rd go | Average |
| | | | |

# DESIGN AND MAKE A PAPER ROCKET

- Does the angle make a difference to the distance travelled?
- Does it make a difference how far you push the straw into the rocket when you blow?
- If students have done the DPSM Foam Rocket activity, can they compare the two types of rocket for (a) distance travelled; (b) accuracy in relation to Fair Testing (e.g. the angle of launching).

**REMEMBER: FOR FAIR TESTING - ONLY CHANGE ONE THING AT A TIME.**

## Further Question:

What do you think might happen if air leaks out of the nose of the rocket? Try and see!

Why do you think this might happen?

## Safety

Do not point the rocket at other children when you are launching it - even though it is soft it might frighten them.

## Follow-up activity

1. Try out different lengths of rocket. Does a longer or shorter rocket make a difference to the distance it travels?

| Length of Rocket (cm) | DISTANCE TRAVELLED (cm) | | | |
|---|---|---|---|---|
| | 1st go | 2nd go | 3rd go | Average |
| | | | | |
| | | | | |
| | | | | |

Conclusion.....

2. Experiment with different shapes of fins and noses

Is there any difference in controlling the direction of the rockets between those with fins and those without fins?

Does the shape of the nose make any difference?

(made by Celine Lynch at 'Space' summer course at BCO, Cork, July 2013).

# DESIGN AND MAKE A PAPER ROCKET

3. Can you think of any other ways of making a paper rocket which might go further?
4. Larger pencils could be tried with larger straws (available from Art and Craft catalogues) to see if these rockets would go further.

## Children Can:

- Find out what rockets have been used for in various places down the years.

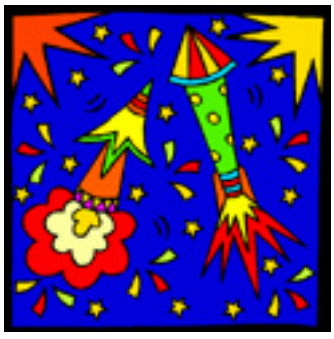
## Did You Know?

- Sound needs something to travel through. Because Space is a vacuum (i.e. nothing there at all, not even air) astronauts use radios to talk to each other. (Radio waves can travel through a vacuum).

- Some of the discoveries during Space research have various uses on the ground: e.g. solar cars, dental work, 'cot death' prevention, and potato crisp factories getting crisps into bags quickly without breaking them!


- In 1865 the science fiction writer Jules Verne suggested using a powerful gun to send people to the Moon!

- Rockets were invented in China over 800 years ago. The first ones were very simple - a cardboard tube packed with gunpowder and attached to a guide stick - a bit like the fireworks we use today.



- A space shuttle is a launch vehicle that blasts into space like a rocket, but it comes back to land on a runway, and can be used again and again.

- Satellites - which beam TV pictures and phone calls around the world, watch the weather, and do lots of other things - are launched into space by rockets or space shuttles.

# DESIGN AND MAKE A PAPER ROCKET

## Useful Websites:

- There is lots more information about rockets on the European Space Agency's website for kids: http://www.esa.int/esaKIDSen/SEMoWIXJD1E_Technology_0.html

- For lots of activities and information about rockets, astronauts, space exploration, space shuttles, solar system, and galaxies, have a look at the American Space Agency's Kids Club: www.nasa.gov/audience/forkids/kidsclub/flash/index.html

**Visit the websites of three space-related Discover Science Centres:**

Blackrock Castle Observatory, Cork www.bco.ie

Birr Castle (home of the giant telescope - the Leviathan), Co. Offaly www.birrcastle.com

Armagh Planetarium, Co. Armagh www.armaghplanet.com