

LOCATION:	TARGET AGE GROUP:
Classroom	KS2
TARGET GROUP SIZE:	DURATION:
10-20 (scale resources for larger group)	Min. 1 hour (ideally 1.5 hrs)

PLPS CITY SCIENCE STARS

Fixture 6: Kick-Off To Lift-Off

SUMMARY:

Pupils will learn about the forces involved in football and rocketry, as well as a brief history of rockets. The topics of Newton's laws of motion and aerodynamics will be simply discussed in relation to rocket science and different types of football kicks (e.g. passes, lobs and shots). Pupils will be shown how to make their own 'rockets' out of paper and how to launch them using stomp-style launchers. The pupils will alter the launch angle of their rockets to match different football shots and try to work out which angles provide the best trajectory for speed, height and distance. Pupils will then discuss how they could improve the design of their rockets and what they could change or measure if they repeated the activity in future.

LEARNING OBJECTIVES:

1. To learn a brief history of rocket science
2. To learn about Newton's laws of motion in relation to rockets and football
3. To learn about how launch angles and speed affect trajectories

PRIOR LEARNING AND LINKS TO KS2 NATIONAL CURRICULUM:

- ✓ Pupils will be learning about the effects of gravity and air resistance on objects.
- ✓ Pupils may be learning about space travel and exploration.

PREPARATION AND RESOURCES:

- ✓ This workshop works best with the use of a computer and projector or a computer-linked smartboard to display the 'KICK-OFF TO LIFT-OFF' PowerPoint slides. If none are available, printouts could be used instead, but these will be less engaging and less environmentally friendly.
- ✓ Stomp-style rocket launchers
- ✓ Empty 2-litre plastic bottles (ideally provided by the children or school to promote reuse and recycling)
- ✓ Plain or scrap paper
- ✓ Scissors
- ✓ Adhesive tape
- ✓ Coloured pens or pencils

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ACTIVITY PLAN:

Introductory activity 1

1. Ask the pupils to identify/locate and name the forces acting on a football as it leaves a footballer's foot and travels into a goal, including gravity and air resistance. Ask how these forces might also be relevant to rockets.
2. Ask the pupils where they think rockets were first invented, and then go through a brief history of rockets ending with modern space exploration.

Main activity

1. Explain to the pupils that they will be making 'rockets' using paper and outline the basic design of a rockets, asking the pupils how the form and function of each part is designed in the context of forces.
2. Help the pupils make their rockets using paper and sticky tape. Encourage them to put their names and own designs on the rockets to help identify them.
3. Discuss with pupils about the different types of football kicks (passes, lobs, shots) and the purpose/strategy of these kicks. Link these to different levels of power and launch angles for adjusting rocket trajectory.
4. Take the pupils outside to launch their rockets. First explain how they work, and then let them take turns using the stomp-style rocket launchers. Encourage them to alter the angles to achieve different results (e.g. height, distance, speed).

Plenary activity (small groups of 3/4 students)

1. Discuss what the pupils found while launching their rockets, focusing on how the angles changed the trajectory of the rocket and how this is similar to kicking a football.
2. Briefly review the learning objectives and propose the take-home challenges.

TAKE HOME CHALLENGE IDEAS:

- Prompt the children to create paper 'rockets' that can be launched from a straw and try them at home, sharing their learning about angles and trajectory.
- Prompt them to research about the rockets currently being designed and used (e.g. SpaceX's Falcon 9 and Falcon Heavy).

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TASK/ASSESSMENT DIFFERENTIATION:

✓ Minimum student goals:

- Make a simple rocket and launch it at two different angles

✓ Target student goals:

- Make a rocket and launch it at a variety of angles

✓ Further goals:

- Adjust the design of the rocket (e.g. weight, number of fins) to improve performance

PUPIL MONITORING AND EVALUATION:

- During the plenary activity, discuss with the pupils what they found during the rocket experiment and quiz them on the roles played by the forces mentioned at the start of the fixture.

DELIVERY NOTES AND ADDITIONAL SCIENTIFIC INFORMATION::

Vocabulary:

- Combustion, acceleration, aerodynamics, gravity, lift, air resistance, trajectory, chemical reaction.