# Stargoal

Thank you for using the Stargoal resources.

Stargoal is a collaboration between primary school pupils and staff, astronomers, sports scientists and footballers.

Each film can be used as a stand-alone resource or combined with others to investigate different areas of Science and Physical Education, with additional cross curricular opportunities including in English, Mathematics and PSHE.

This resource is designed to provide suggestions of how to use the Stargoal: Gravity video, with possible extensions to take the learning further.

## Health and Safety and Emotional Well-being

You should perform a full risk assessment before undertaking any of these suggested activities. All activities should be assessed according to your own setting and aligning to local guidelines and recommendations including appropriate warm up for physical activity i.e. CLEAPSS ([www.primary.cleapss.org.uk](http://www.primary.cleapss.org.uk)) and Association for Physical Education ([www.afpe.org.uk/physical-education/](http://www.afpe.org.uk/physical-education/)).

Within the context of this activity, children will have successes and failures at kicking a ball and playing football, and they will also be asked to give constructive advice to other players. Consider the positive and safe learning environment to allow this to be an enjoyable experience for all.

# Stargoal: Football and Gravity

## Lesson Summary

Children observe and explore the process of kicking (or sending) a ball in a straight direction, then attempt to ‘chip’ the ball into the air and observe the ball travelling towards the ground. Children discuss the forces involved and explore the force due to gravity. They also predict how the force due to gravity will differ on different planets.

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| Curriculum Phase: | Upper Key Stage 2 |
| Suggested duration: | 60-90mins |
| Location: | Classroom and Outdoor or Indoor space suitable for sports activities |

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| Resources: | Stargoal Video Size 4 footballs (balls suitable for your group)Cones (or goals)Meet the Team - People Portraits |
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| National Curriculum Objectives | **Working scientifically:** * Using observations and ideas to suggest answers to questions.

**Forces:*** To observe that unsupported objects fall towards the Earth because of the force due to gravity acting between the Earth and the falling object.
* To observe that forces make things begin to move, get faster or slow down.
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| **Physical education:** * Master basic movements, including agility balance and coordination, sending (kicking) a ball for accuracy.
* Participating in team games; exploring and developing simple tactics for attacking and defending including outwitting opponents.
* Developing an understanding of how to improve, learning how to evaluate and recognise own success.
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| **PSHE including statutory RSHE:** * Facilitating the development of active citizenship e.g. How to treat themselves and others with respect; how to be polite and courteous, how to listen to other people and play and work cooperatively.
* Knowing and understanding that everyone has different strengths, building knowledge too, of the roles and responsibilities different people have (footballers, astronomers, scientists, schools).
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| Key Vocabulary | **Science**: *force, push, pull, gravity,* contact force, non-contact force Working scientifically: prediction, evidence, findings, conclusion**Physical Education:** sending and receiving, kicking, chipping, lifting, direction, travel, inside/outside, lift, drop, momentum, swing, strike, aim, downward.**PSHE & RSHE:** Talking about emotions accurately and sensitively, building knowledge of e.g. empathy, resilience, respect, cooperation, leadership, teamwork, strengths, challenge. |

## Background information

A force is required to make something move faster, move slower, or change direction, or even change the shape of an object. When we kick a football, we are providing a push force causing the ball to move forward.

The force due to the gravity of the Earth pulls objects towards the centre of our planet. It is a non-contact force, so it’s attracting objects without any physical contact. It is what makes unsupported things fall, and what stops us floating away into space. As such, the force due to gravity is a pull force, pulling objects, including the football and the players, towards the Earth. This means that the kicked ball returns to the ground and does not continue to travel upwards.

It is not just the Earth that has gravity. If we think about different objects like a football, a table, even you and me, they are all made of “stuff”, of matter. Planets, moons and stars are also made of matter. How much matter an object has is measured by its mass. The force due to the gravity of an object depends on its mass. The more massive an object is, the stronger its gravitational pull. For example, the moon is less massive than the Earth so it has a much lower gravitational pull. We could kick a football much higher and further on the moon. However, the planet Jupiter is more massive than the Earth and so, if we kicked our football there, we could struggle to get it off the ground.

## Science Capital Opportunities/Suggestions

We hope **Stargoal** will provide an opportunity to help develop and broaden your pupils’ Science Capital. The Science Capital Teaching approach is an evidence-based justice-orientated approach to teaching science - For background and information about Science Capital see: [PSCTA](https://www.ucl.ac.uk/ioe/departments-and-centres/departments/education-practice-and-society/stem-participation-social-justice-research/primary-science-capital-project)

Do any children in the class have a particular interest in football? Could they act as an ‘expert’ supporting others in developing their skills in playing football, or giving examples of what has worked well for them, their teams, etc.?

Is there a local football team that the children are aware of/involved with? Perhaps a family member that plays and might be interested in being involved?

Similarly, some children may be particularly strong in data collection/data analysis, consider how they could be more involved in developing and extending this lesson.

This activity also gives an opportunity to develop personal learning skills including reflective practice, evaluating and improving our own skills, whilst considering the importance of supporting others and coaching positively.

## Suggestion of how to use the video

This video is designed with pause points for class/small group discussion, and/or physical activities. However, we encourage you to use this film in any way that works for your setting. For example, you could play the whole video then complete activities separately or complete all the activities before watching the video and following the discussion points.

**Challenging stereotypes**: Prior to watching these videos, you may be interested in your pupils’ pre-conceptions of particular careers, e.g. who plays football or who does astronomy? What do they do in their job roles? After watching the films, do these ideas match what they have found?

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| Preparation –before watching video | **Class discussion**Suggestion questions: What do you think an astronomer does? What skills do you think they would need in their role? What do you think a footballer does? What skills do you think they need to be successful players?Use elicited answers to gauge pupils’ ideas about and interests in astronomy and space, and sport. Do certain pupils have a particular interest in one or the other? Are there imaginative responses and/or fact based? Are there any overlapping skills that are mentioned, or distinct differences? |
| Introduce video | We are going to meet children in another school, working with astronomers Sownak, Alis and Isabel. |
| Play video | *Video content: Alis, an astronomer, and the children discuss the role of an astronomer, and consider what the links between forces and football.*  |
| Pause at ~1min 30sec | **Class discussion: Compare your class’s responses to those on the video.** Suggested prompts:What is a force?Elicit responses from the class. Can you get a class definition that everyone is happy with? e.g. A force makes something move faster, move slower, or change direction, or even change the shape of an object. Can you think of any examples of forces? Opportunity to revisit the forces that the children are aware of and any misconceptions. NB: A few examples are given in the video but your class may be aware of others NB: KS1 and lower KS2 children should be familiar with the idea of a push or a pull force (and may have some knowledge of friction). |

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| Play Video | *Video content: Alis and the children discuss forces and the forces involved in kicking a ball.* |
| Pause at ~2min 08sec | **Class discussion: Compare your class’s responses to those on the video.** What forces are involved in kicking a ball? Elicit responses from the class, check understanding and any potential misconceptions. **Extension:** Some pupils may wish to draw this using arrows to show the forces applied or act it out.  |
| Play video | *Video content: Alis discusses the force due to gravity.* |
| Pause at ~3min 02sec | Class physical activity: Kicking a ball into the airKick a ball into the air. What do you notice when it moves? We are approaching this activity as scientists, so what skills are we going to use? You may wish to divide the class into groups and assign roles such as observer, kicker, receiver, ball collector. It is important that they are not merely kicking the ball in all directions, but observing and discussing the science of the ball’s movement.Children may choose (depending upon ability) to kick the ball:* **From a bounce and kick:** Using two hands bounce the ball to the ground in front of you, try to kick the ball upwards and catch in your hands- repeat.
* **Out of the hands:** Drop the ball towards the ground, kick or knee the ball up into the air and catch the ball in both hands.
* **From a ‘chip’** (building on from above), try lifting a grounded ball into the air. The toes are dug beneath the ball and flick upwards (think lift rather than chip). Feel as though the ball is rolling off the toes. Kicking leg still follows through. Grounded leg has a soft knee bend.
* **As a chip kick**, chipping the ball over a partner (ensuring we are not aiming at our partner)
* **Chipping a ball towards an open or goalkeeper defended goal**.
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| Play video | *Video content: Sownak, Isabel and the children observe and discuss the movement of the ball in the air and towards the ground.* |
| Pause at ~5.05 | **Class discussion:** Sharing their understanding of gravity, based on their experience and observations from their own physical activity session kicking the ball into the air.Compare this to the astronomers and the children in the video.Suggested prompts:* What do you notice about the ball after it is kicked into the air?
* What does it always do?
* What force causes the ball to travel downwards after being kicked into the air?
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| Pause at ~5min 10sec | **Class discussion: What do you think would happen if we kicked the ball on the Moon?** Elicit responses from the class. Suggested prompts: Is there gravity on the Moon? How would we know/find out? Do we think there is more or less gravity on the Moon than Earth? (Consider the children’s understanding and conceptions of the ‘size’ of the Moon in comparison to the Earth – e.g. mass, diameter)You may want to investigate this further (e.g. look at film footage from moon landings, or demonstrate with an inflatable globe and tennis ball to represent the Earth and the Moon).  |
| Play video | *Video content: Alis and the children discuss what would happen to the ball on the Moon.* |
| (Optional) Pause at ~5.42 | **Class discussion: What do you think would happen if we kicked the ball on Jupiter?** Elicit responses from the class. Suggested prompts: Do we think Jupiter is more or less massive than Earth? How would we know/find out? Do we think there is more or less gravity on Jupiter than Earth? (Consider the children’s understanding and conceptions of the ‘size’ of Jupiter in comparison to the Earth – e.g. mass, diameter) |
| Play video | *Video content: Alis discusses what would happen to the ball on different planets.* |
| (Optional) Pause at ~6.26 | **Class discussion: What do you think would happen if we kicked the ball on other planets?** Elicit responses from the class. You might want to investigate the different masses and gravitational pulls of the planets in our Solar System, or even beyond.  |
| Play video | *Video content: The class and the astronomers visit the Ogden Centre where the astronomers work to explore how gravity affects the astronomers’ research.*  |
| Plenary | **Class discussion**What did you find out from this video?What do you think about Alis and the class’s explanation of gravity? How would you describe gravity and its effects in football to a friend?What questions would you like to ask the astronomers?  |

## Possible extension activities:

* You may also want to discuss other planets in the Solar System – what do they think might happen there? You might want to investigate the different masses and gravitational pulls of the planets in our Solar System, or even beyond.
* Imagine being a TV commentator for a football match on the Moon (or another planet). Write the script describing the match.
* Write a job description for a footballer on the Moon (or another planet).
* Design a poster or make a video advert for this video. What are the key things that you discovered?
* Write a postcard giving advice to a footballer using learning from this video.