

# Spinning water (Newton's Laws of Motion) Worksheet

## Learning outcomes

By doing this activity you will learn about Newton's 3 Laws of Motion and how these are applied on earth. You will also explore job roles and learn more about Scotland's space industry.

## Introduction

Gravity, the force that pulls you down to the ground, exists on Earth. In basic terms, forces are pushes and pulls. Sir Isaac Newton developed 3 laws of motion that are still used today when describing how objects move in straight lines, but they can also be applied to objects that spin.

1. **Newton's 1st Law:** An object will remain at rest unless acted upon by a force. Once moving that object will continue to move in a straight line forever, unless acted upon by another force.
2. **Newton's 2nd Law:** Force equals mass x acceleration ( $F=ma$ )
3. **Newton's 3rd Law:** For every action there is an equal and opposite reaction

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## Activity - Try at home

### Spinning Water

You will need:

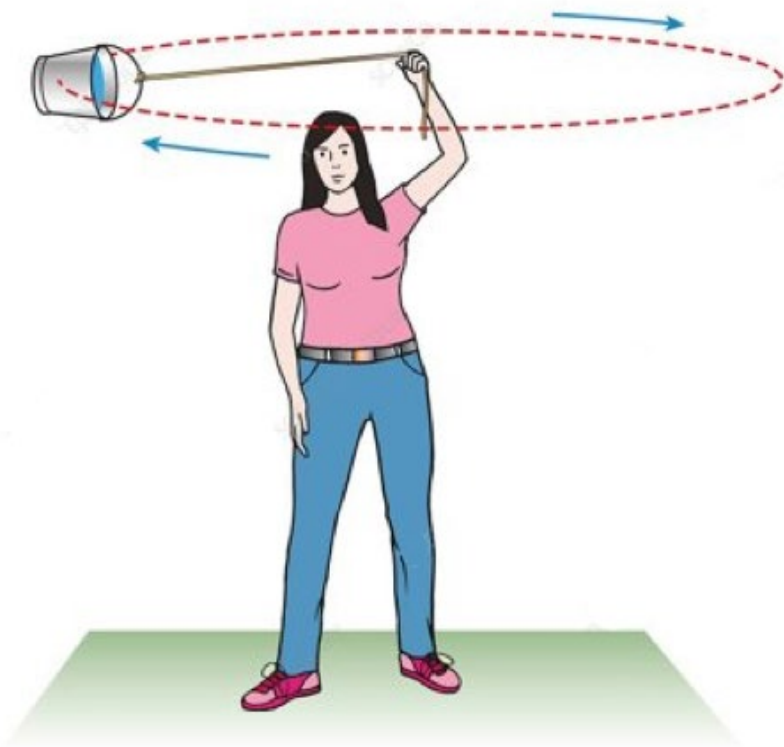
- ★ Frisbee or bucket with a handle
- ★ Rope or strong nylon cord
- ★ Plastic cup
- ★ Water

An adult should help you with this activity – they'll find it fun too!

You can watch this [video](#) (1) to help you with the experiment.

If you are using the frisbee, drill or pierce 3 holes at equal distance around the edge of the frisbee. Get an adult to do this so you don't hurt yourself. Cut the nylon cord or rope into 3 equal lengths and thread through the holes. Tie all the lengths together in a strong knot (if using the bucket, cut a length of rope or nylon cord and tie it to the bucket handle).

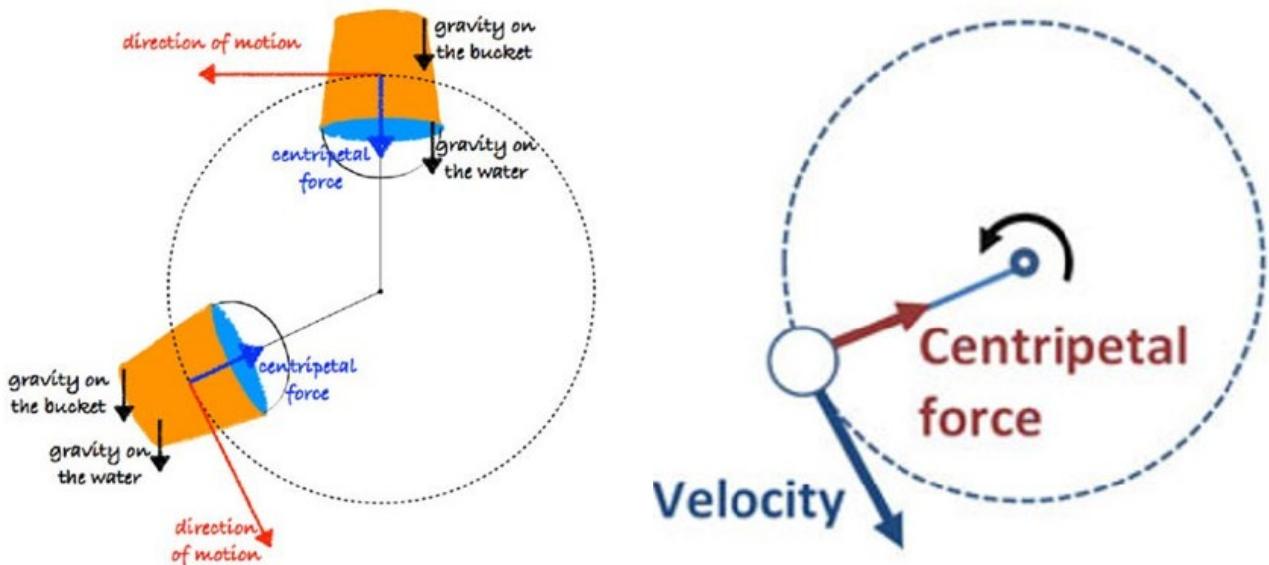
First, practice by spinning the frisbee/bucket around without any water. You are pushing it away from you, but since its attached by rope, it is pulled back towards you (Newton's 3rd law - equal and opposite reaction).



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### Now add the water – but how does it not fall out when it spins upside down?!

The water must always move along a straight line to the centre of the circle (Newton's 1st Law). This force is called Centripetal Force. As you spin the frisbee and water around, the rope provides the Centripetal Force, pulling the water towards the centre of the circle. When it spins upside down, the frisbee/bucket is being pulled towards the centre of circle more than gravity is pulling on the water, and is then quickly pushed away, so the water does not fall out (Newton's 3rd Law).



Satellites stay in orbit around Earth due to Centripetal Force. Imagine your hand holding the rope is Earth, the frisbee/bucket is the satellite and the ropes are the Centripetal Force. A satellite is effectively always falling towards Earth in a straight line, but at the same time Earth is spinning away from it.

**Physicists** (2) use concepts such as Newton's Laws of motion every day. Physics is the study of how everything works, so there are lots of areas to cover, not just forces and motion. Physicists use their knowledge of forces to help launch satellites and astronauts into space.

**Aerospace** (3) and **Design engineers** (4) would be involved in the creation and design of spacecraft and launches. Before computers, humans used to calculate the maths involved in satellite and rocket launches, now that is done using advanced technology but that still needs people such as data scientists and engineers.

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Have a look at the My World of Work website to find out more about these roles and the skills needed.

Some other roles include:

[Robotics engineer](#) (5) [Astronaut](#) (6) [Data scientist](#) (7) [Big data engineer](#) (8)  
[Electronics engineer](#) (9)

Scotland has a current and thriving space industry. Scotland has been highlighted as an excellent satellite launch site, with proposed sites in development at Prestwick Airport and Sutherland in the north of Scotland. In fact, Glasgow Prestwick Airport aims to become the first commercial spaceport in the UK and Europe offering horizontal launches, as it benefits from the already available runway.

The UK Space Agency has awarded funding for the development of the first UK vertical launch site (UKVL) in Sutherland. Roles available at these sites will be engineers and technicians involved in the development and launch of the satellites, but also involved in the building and maintenance of the launch sites. Explore some of these job roles here and explore what skills they use.

[Satellite systems technician](#) (10) [Materials engineer](#) (11) [Structural engineer](#) (12)  
[Construction manager](#) (13) [Business development manager](#) (14)  
[Project manager](#) (15)

## Follow up

We've looked at several different job roles and if you would like to learn more about Scotland's space industry, check out these organisations using the links.

- [Space Hub Sutherland](#) (16)
- [Prestwick Aerospace](#) (17)

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## Website references

1. Spinning Water activity guide film <https://bit.ly/2zFwLyl>
2. Physicist <https://bit.ly/2XgpAo2>
3. Aerospace engineer <https://bit.ly/2WO5Dpu>
4. Design engineer <https://bit.ly/3bOd9VZ>
5. Robotics engineer <https://bit.ly/2ZAsZB9>
6. Astronaut <https://bit.ly/2ym6yV1>
7. Data scientist <https://bit.ly/3cQVqOF>
8. Big data engineer <https://bit.ly/3gddjcX>
9. Electronics engineer <https://bit.ly/3g3H3ZD>
10. Satellite systems technician <https://bit.ly/3g61q8h>
11. Materials engineer <https://bit.ly/3cPfG3g>
12. Structural engineer <https://bit.ly/2TnZlLe>
13. Construction engineer <https://bit.ly/3g9UwPt>
14. Business Development manager <https://bit.ly/3bR0RMq>
15. Project manager <https://bit.ly/2LGfOq2>
16. Space Hub Sutherland <https://bit.ly/2AgxwOU>
17. Prestwick Aerospace <https://bit.ly/37w72Fj>