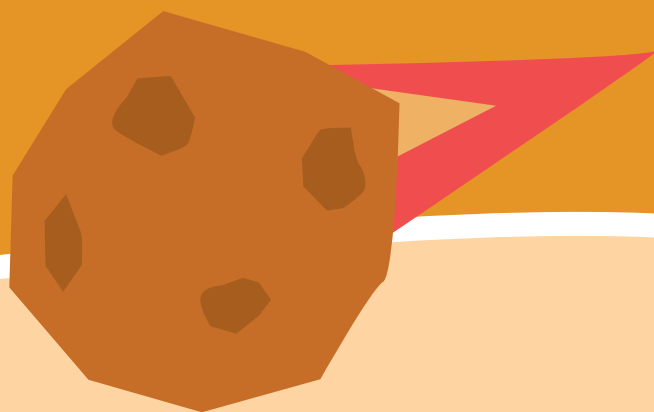




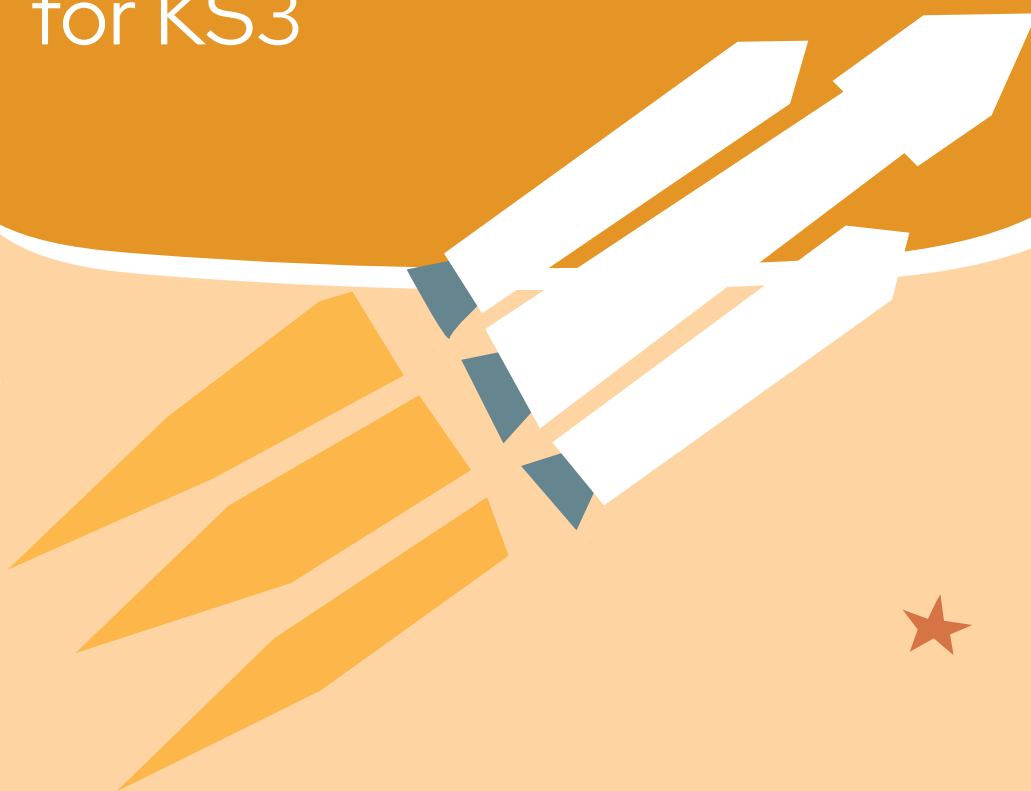
Winchester
Science Centre

By Wonderseekers



Blast Off!

Pre-visit resources
for KS3



KS3 - Blast Off!

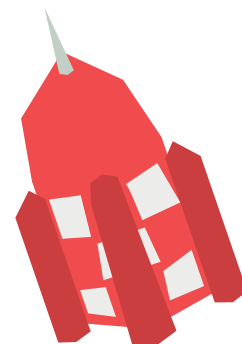
These activities are designed to be completed before you visit for your Blast Off! workshop. We recommend working through the activities from 1 to 4, but you are welcome to pick and choose depending on your group's prior knowledge and any ideas they may spark along the way.

Through these activities, you will be exploring a few of the different forces that impact on rocket ships during their flight. This will include investigations into friction, air resistance and the importance of mass during flight.

Teacher Guide

Learning Objective

- To understand that there are key forces involved in flight, including mass, lift and air resistance.
- To explore how mass and air resistance impact the movement of an object during flight.



Key Science

Everything in our world is constantly experiencing different forces. These forces are pushes and pulls that act on an object due to its interaction with something else in our world. We are going to focus on mass, friction and air resistance. Mass, friction, and air resistance all affect how objects move, the speed they move at, the distance they travel, and how much force is needed to move them. Mass is how heavy an object is. The more mass an object has, the more force is required to move it.

Friction and air resistance are both kinds of resistance forces, which means they oppose the forces moving an object. For example, when you are walking, you are pushing yourself forward, which will cause friction and air resistance to oppose you. Friction is a force between two surfaces when they are trying to slide against each other. Here, the friction slows down the surface, with rougher surfaces generating more friction and slowing down faster. This is why we wear trainers when running around, as they have rougher soles and stop us skidding over.

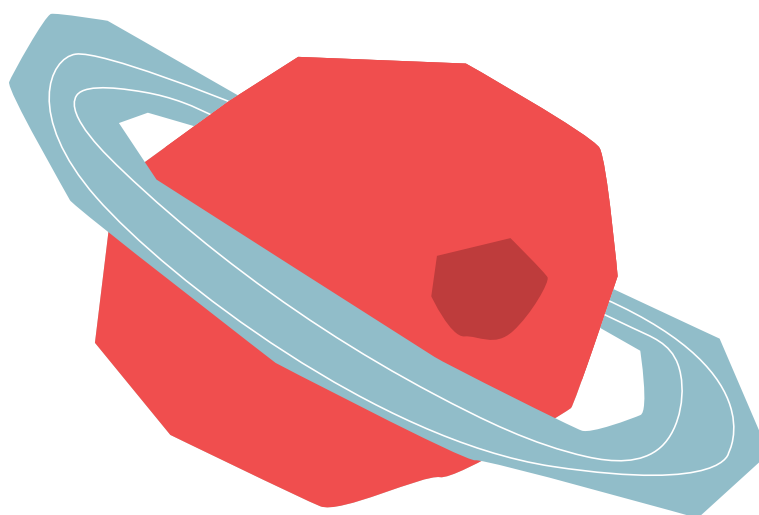
Air resistance is very similar to friction, but instead of two surfaces sliding against each other, it is caused by friction between the air and another material. If something has a large surface area, it has more space for the air to push against it, leading to a greater air resistance. This is how parachutes work – by having such a large surface area that the air resistance stops the wearer from falling to the Earth.

Curriculum Links

- Forces as pushes or pulls, arising from the interaction between two objects
- Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets, and forces due to static electricity.
- Make and record observations and measurements using a range of methods for different investigations, and evaluate the reliability of methods and suggest possible improvements

Key terms

- **Push & Pull** – These are opposite forces (demonstrate pushing and pulling).
- **Fuel** – A resource that is burned/used to produce energy.
- **Direction** – The way something is moving.
- **Distance** – A measure of how far something moves.
- **Mass** – Mass is the amount of matter or substance that makes up an object, usually measured in kilograms (kg).
- **Weight** – The force acting on an object due to gravity.
- **Friction** – This is the force between two forces sliding together or across each other.
- **Force** – A force is a push or a pull acting on an object. We can use forces to change the direction of an object.
- **Aerodynamic** – Having a shape which reduces the drag from air moving past.
- **Air resistance** – The force that opposes the movement of an object through air.
- **Newtons** – The standard unit for how we measure how much force is applied.
- **Lift** – The upward acting force on an aircraft.



Activity 1 – What are some things that fly? How? (5–10 minutes)

Overview

This activity introduces the concept of flight and encourages a creative discussion about how things fly. Have a discussion with your class about what kinds of things can fly and what we need to be able to fly.

You will need

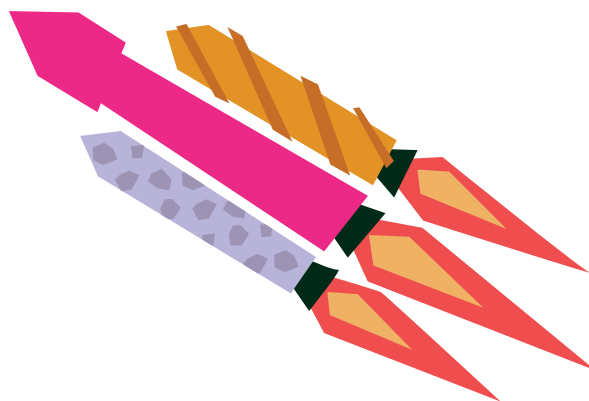
- Pictures of different flying things (e.g. animals, machines, superheroes).
- Pens and paper.

Instructions

1. Come up with a list of different things that fly! See how many you can come up with and group them based on how they fly. Think about what they need to fly. (E.g. birds flap their wings, aeroplanes have an engine and have a runway for a 'run-up', helicopters have spinning rotor blades). Have a discussion about the different groups that emerge and identify whether there are any similarities between them.
2. With each flying "thing" get the students to identify the different forces that are acting on the thing, including what the thing is doing to generate force and what resistance forces might be acting on it.

Take it further

What is true flight? Have a discussion with the students.



Activity 2: How does friction affect moving objects? (15–20 minutes)

Overview

Find out how the shape/and material of an object affects the way it moves through the air. We will be using different materials see if we can build up air resistance to slow the descent of a falling object.

You will need

- Teddy/stuffed animal/or other object to slow down.
- Variety of arts/and crafts materials.
- Pieces of different fabrics.
- String/tape/glue.
- Card/paper/cardboard/egg boxes etc.
- Staircase or other place to drop items from.

Instructions:

1. Children get into small groups (3–6 per group), each group gets given a teddy bear/ stuffed animal/object to slow down the fall of.
2. Children use the provided materials to create something that will allow their teddy bear to fall as slowly as possible. They can test as they go by dropping it from their head height/as high as they can reach.
3. For older children: Try to avoid using the word parachute as they'll go straight to making something that looks like a parachute without thinking about why
4. When they're finished, take the parachutes up to a stairwell or similar and drop them one by one, seeing how long they all take to fall and discussing why.

Take it further

- What is it about the materials that makes them fall at different speeds?
- Does the size of the material used matter? Does the mass matter? Does the shape matter?
- How would designing a parachute for a human be different?
- What about a rocket capsule?
- What about if you wanted something to fall as quickly as possible? What would you change?



Activity 3: How does mass affect moving objects? (20–30 minutes)

Overview

In this activity we will be exploring how mass impacts an object during flight. For Rocketships, scientists have to be really careful about getting the weight right or they will come crashing down to Earth. To explore this, you will be constructing paper airplanes, and then increasing their weight to see how it impacts their flight.

You will need

- Thin card or paper.
- Tape.
- Coloured cones.
- Small objects with mass (multi-link cubes, lego bricks, weights, etc.).

Instructions:

1. Lay out the cones in a straight line. These will act as markers to see how far the planes fly.
2. Break the students up into groups. Each group will make their own paper airplane. The airplanes will then be launched along the markers and tape will be placed where they land.
3. Once each group has collected their plane have them start adding weight to it. This could be done by taping weight to the side, or drawing on the plane using colouring pens. It's up to you how much weight you want them to add.
4. Once they have added weight to it, have them throw it again. The airplane should be more unstable and not travel as far. Mark the new distance with some more tape.
5. Keep doing subsequent throws where the weight is increased and marking their new results. As the throws progress the planes will be harder to throw/and will stop going as far.
6. Conclude the activity with the class, discuss how the weight became challenging for the planes to overcome during the flight causing them to go off course and crash earlier.

Take it further

Was this experiment comparative? Ask the students what conditions they could set to make the experiment.

