SKY HIGH

An investigation into air resistance

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Up, up and away!

FLYING LESSON 1:
What makes something fly?

Thrust pushes it forward

Four forces affect any flying plane, bird or custard pie…

Drag slows it down

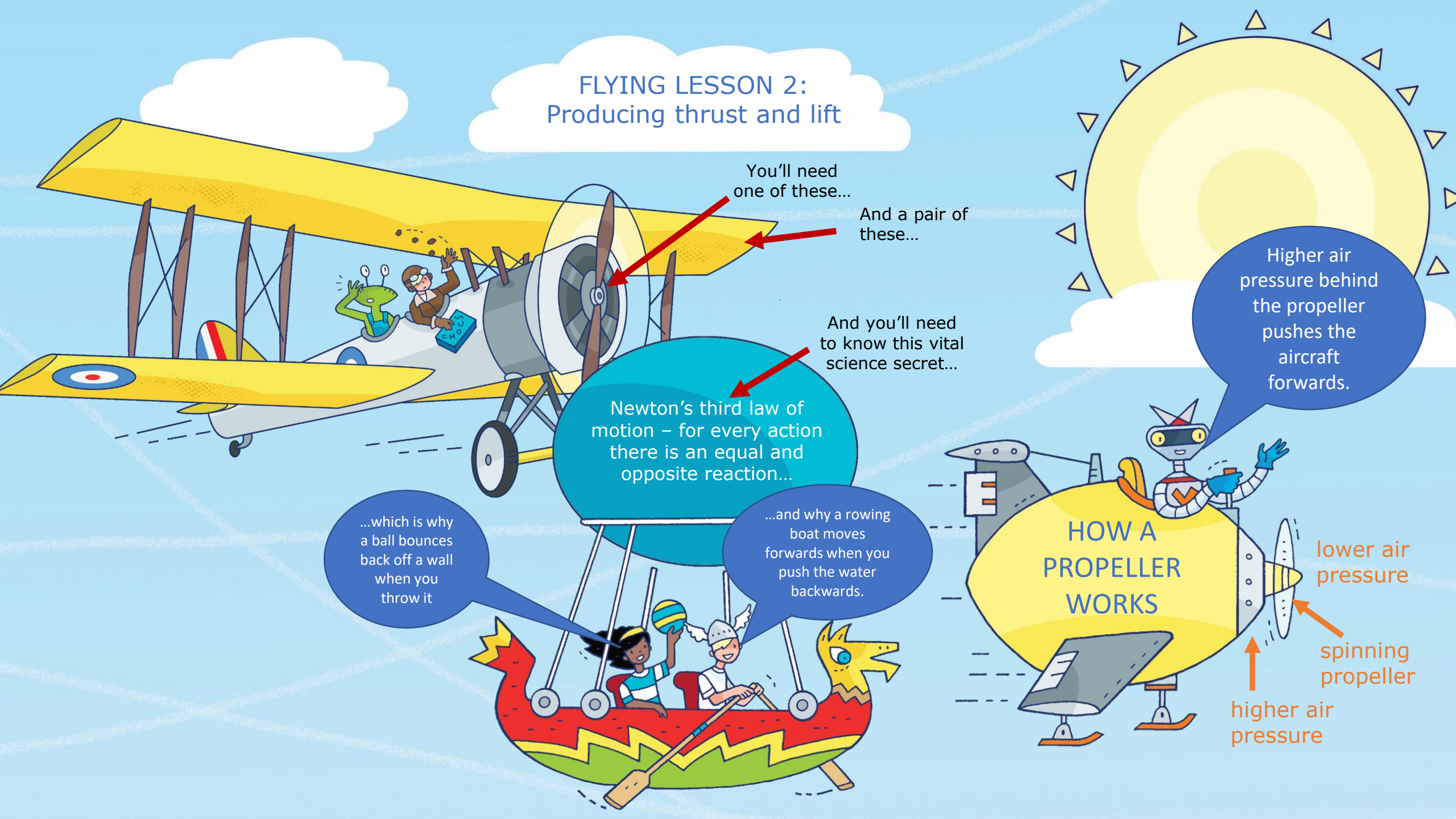
Gravity pulls it down

Lift pushes it up

These pairs of forces work against each other. Drag acts against thrust and gravity acts against lift. Your magnificent flying machine will fly if it has enough thrust and lift to overcome drag and gravity.

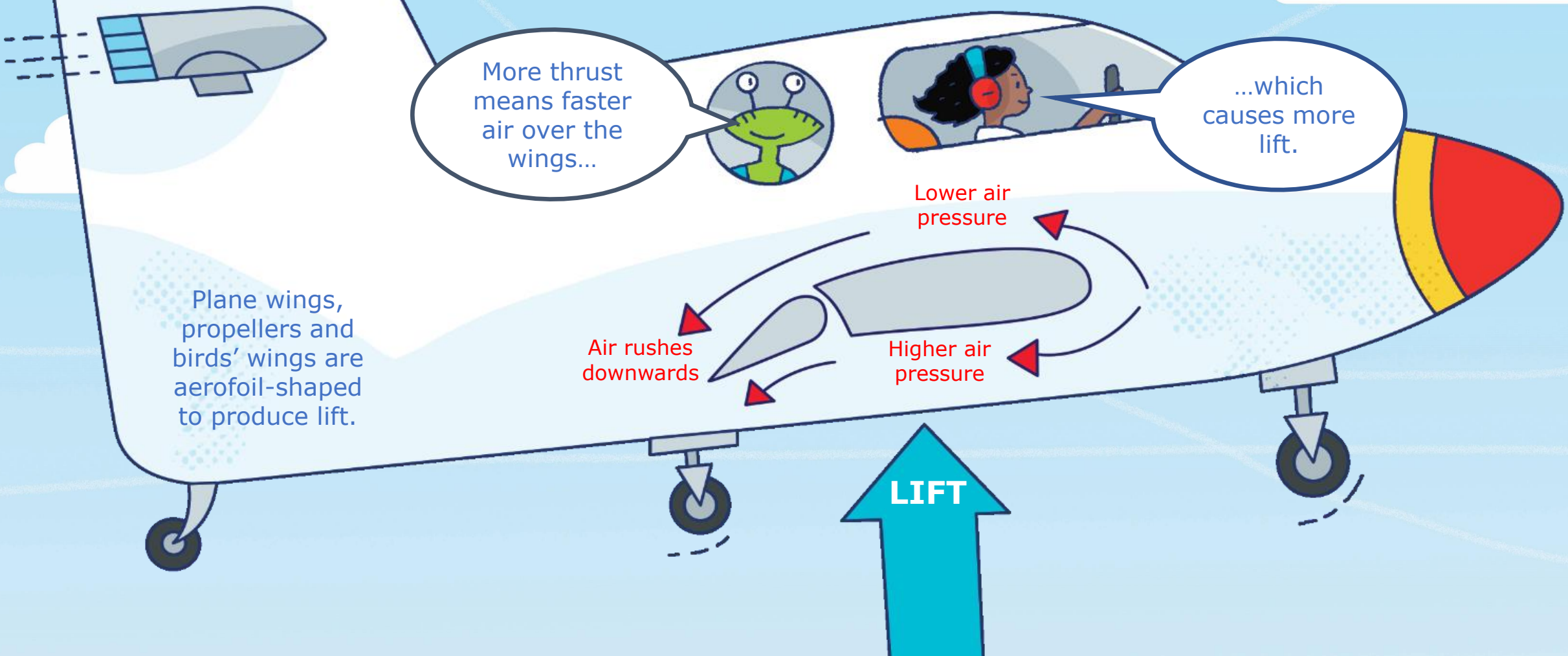
Drag, or air resistance, is a form of friction that slows down objects moving through the air. Gravity makes unsupported objects fall towards the Earth.

FLYING LESSON 2:
Producing thrust and lift



HOW WINGS CREATE LIFT

As a plane speeds along the runway, air flows around the wings. The curved shape of the wings (called an aerofoil) creates a pressure difference between the top and bottom of the wing: the air forced below the wing has a higher pressure than the air forced above it, which pushes the wing upwards, creating lift.
Another way of thinking about it is that the shape and angle of the wing makes the air coming off the wing flow downwards. This produces an upward force on the wing and creates lift. It's Newton's third law of motion in action!



Plane wings, propellers and birds' wings are aerofoil-shaped to produce lift.

FLYING LESSON 3:

Why can’t I fly like a bird?

To fly like a bird you’d need a body like a bird.

FLYING LESSON 4:

How to fly without wings

Helicopters don't have wings. Their rotors are combined propellers and wings. Rotors are aerofoil shaped to produce lift. By altering the angle of the rotors, the pilot produces thrust.

spinning rotors

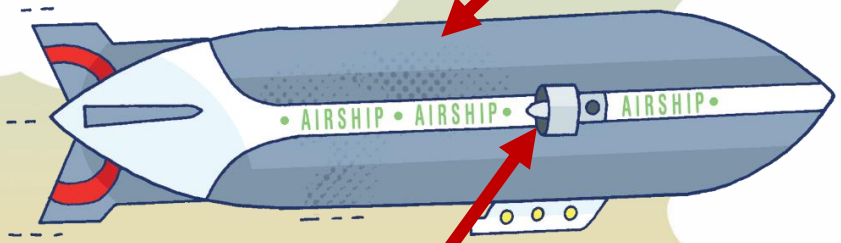
spinning rotors

Rotors allow a helicopter to take off vertically and fly in all directions.

Airships and balloons don't have wings either...

Hot air inside the balloon weighs less than the same volume of cooler air outside.

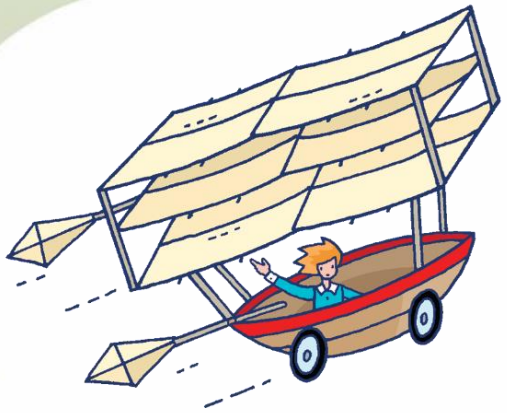
Lighter-than-air helium gas in here.



Engine and propeller provides thrust.

GLIDING HIGH

Gliders have wings but no engine. They take to the air with the aid of a powered aircraft or high-speed winch and they use pockets of air to get more lift. If the ground is hot, warm air will rise. Air also rises if wind hits a mountain. If there is no rising air, the glider loses height smoothly and gradually.



Rising hot air is called a thermal. Hawks and other gliding birds also make use of these thermals.

Straw plane investigation

What you do:

1. Cut out the paper strips.
2. Loop the shapes marked A and secure with sticky tape.
3. Fold along the dotted lines of B, C and D and secure with sticky tape.
4. Stick an A loop to one end of each of the three straws.
5. Stick B, C and D to the other ends of the straws.

Test your straw planes like a scientist!

When scientists conduct an experiment, they follow these simple rules to make sure it is a fair test.

1. **Make each test as similar as possible**. Always stand in the same place to throw your planes, throw them in the same direction and try to use the same amount of force.
2. **Repeat your experiment**, in case something goes wrong with the first test. Try throwing each plane three times and then record the measurement that isn't the longest or the shortest. Or, to be even more accurate find the average (mean) result.

Use the group sheet to plan your investigation.

If you changed just the shape of the plane and you were testing how far they flew (distance), here is an example table.

	Test 1	Test 2	Test 3	Test 4	Test 5	Mean distance flown	Other observations
Square shape plane							
Circle shape plane							
Triangle shape plane							
Your own plane							
Your own plane							

How to work out the mean result:

1. Throw one of the straw planes and write down the distance it flew.
2. Throw the same plane four more times, writing down the distance each time.
3. Now add together all five distances.
4. Divide the total number by five (the number of tests). This is the mean distance flown.