

Science

Forces Year 5

Remember when

- Changed shape of materials by stretching, twisting, bending and squashing. (Y2)
- Push and pull are types of forces (Y3)
- That when forces are applied to an object they allow them to move or stop moving (Y3)
- Strength of the force determines how far and fast an object moves. (Y3)
- Friction is the resistance of motion when there is contact between two surfaces. (Y3)
- The force that causes objects to move downwards towards the ground is gravity. (Y3)
- That magnets have poles, and that opposite poles attract, while similar poles repel. (Y3)

Sticky knowledge

- Friction is a contact force e.g. trainers or mats for a helter skelter
- Gravity is a force that acts at a distance, pulling objects towards the Earth, causing them to fall
- A force causes an object to start moving, stop moving, speed up, slow down or change direction
- Air resistance is a contact force e.g. parachutes
- Water resistance is a contact force e.g. the shape of a shark to help it move easily through the water
- A mechanism allows a small force to move a larger object
- Pulleys, levers and gears are all mechanisms

Key vocabulary

Force, gravity, Earth, air resistance, water resistance, friction, mechanisms, simple machines, levers, pulleys, gears

National Curriculum

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces
- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

Common Misconceptions

Some children may think:

- the heavier the object the faster it falls, because it has more gravity acting on it
- forces always act in pairs which are equal and opposite
- smooth surfaces have no friction
- objects always travel better on smooth surfaces
- a moving object has a force which is pushing it forwards and it stops when the pushing force wears out
- a non-moving object has no forces acting on it
- heavy objects sink and light objects float

LO	Knowledge and Skills	Lesson outline
<p>Lesson 1</p> <p>LO: To understand what gravity is.</p> <p>Enquiry type Comparative and fair testing</p>	<p>Sticky Knowledge: Gravity is a force that acts at a distance, pulling objects towards the Earth, causing them to fall</p> <p>A force causes an object to start moving, stop moving, speed up, slow down or change direction</p> <p>Focus skill Identify scientific evidence that has been used to support or refute ideas or arguments</p>	<p>Recap forces from year 3- pushes, pulls, magnets etc</p> <p>In this lesson pupils need to be taught about Newton Meters and how to use them before using them in the lesson to measure the weight of different objects around the classroom.</p> <p>Explain the different theories surrounding gravity posed by Galileo and Aristotle. Which do they think was correct?</p> <p>Explore the theory by dropping two identical containers, one full and one empty, from the same height. Discuss what happened, why this happens and whose theory was correct – this will be revisited during the air resistance lesson.</p> <p>LA – template given for table.</p> <p>ARE – Specify items to measure</p> <p>GD – Choose items to measure.</p>
<p>Lesson 2</p> <p>LO: To understand the effects of friction.</p> <p>Enquiry type Pattern seeking</p>	<p>Sticky Knowledge: Friction is a contact force e.g. trainers or mats for a helter skelter</p> <p>A force causes an object to start moving, stop moving, speed up, slow down or change direction</p> <p>Skill: Taking measurements, using a</p>	<p>Recap what the children learned about friction in Year 3. How can we measure friction?</p> <p>Children will discuss and carry out an enquiry to compare whether rougher surfaces create more friction.</p> <p>Use a newton meter to drag a shoe across different surfaces (wood, plastic, carpet, grass, concrete/tarmac) and record the force it takes to make the shoe move. Discuss the patterns that they have noticed and record in books.</p> <p>LA – template given for table.</p>

	range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate	ARE – Mixed ability groups. GD – Predict the pattern before carrying out the enquiry.
<p>Lesson 3</p> <p>LO: To understand the effects of air resistance.</p> <p>Enquiry type Comparative and fair testing</p>	<p>Sticky Knowledge: Air resistance is a contact force e.g. parachutes</p> <p>A force causes an object to start moving, stop moving, speed up, slow down or change direction</p> <p>Focus skill Using test results to make predictions to set up further comparative and fair tests</p>	<p>Children will discuss and carry out a comparative enquiry to find out how the size of a parachute affects the rate at which it falls.</p> <p>Recap what the children have learned about gravity and discuss how this can balance out air resistance, and what air resistance is. Discuss what affect air resistance has on the parachute and why this makes it fall at a different rate.</p> <p>Discuss the variables in this experiment (explain the different types). What are we going to change? What are we going to measure? Keeping all other variables the same will ensure that the enquiry is kept fair.</p> <p>Children will then create parachutes of different sizes. These will be dropped from the same height and children will time how long it takes for the parachute to reach the floor.</p> <p>LA – template given for table, mixed ability groups</p> <p>ARE – Mixed ability groups</p> <p>GD – Create their own parachutes using different materials rather than different sizes.</p>
<p>Lesson 4</p> <p>LO: To understand the effects of water resistance.</p> <p>Enquiry type Comparative and fair testing</p>	<p>Sticky Knowledge: Water resistance is a contact force e.g. the shape of a shark to help it move easily through the water</p> <p>A force causes an object to start moving, stop moving, speed up, slow down or change direction</p> <p>Focus skill: Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate</p>	<p>Recap air resistance. What do you think water resistance might be?</p> <p>How can you make an object move more smoothly through water (reduce water resistance)?</p> <p>Discuss streamlining and that this enables animals/vehicles to cut through the water in order to move more easily/quickly.</p> <p>Children will create and test 3 different 3D shapes from plasticine/playdoh to see which one creates the most/least water resistance.</p> <p>Shapes will be dropped into a measuring cylinder of water and children will measure how long it takes them to reach the bottom of the cylinder.</p> <p>Compare this to everyday life: Which animals have streamlined shapes to create less water resistance?</p> <p>LA – TA assisted – 3D shapes already given.</p> <p>ARE – make shapes using plasticine/playdoh</p> <p>GD – Add one more shape of their own and predict how it will be affected by water resistance.</p>
<p>Lesson 5</p> <p>LO: To understand how levers allow a smaller force to have a greater effect</p> <p>Enquiry type Comparative and fair testing</p>	<p>Sticky Knowledge: A mechanism allows a small force to move a larger object Pulleys, levers and gears are all mechanisms</p> <p>Focus skill Report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations</p>	<p>Children will design an investigation using a rubber as a fulcrum and a ruler as a lever, to see which masses they can lift by changing the length of the lever.</p> <p>Results will be recorded in a table and children will write a conclusion to explain the relationship between the length of the lever and the mass they could lift.</p> <p>Pupil-led enquiry – children will create the enquiry themselves using different materials (potential weights can include lego, a bucket with marbles in, 10g stacking weights).</p> <p>LA – TA assisted – as one group (mainly using Lego)</p> <p>ARE – Design investigation in mixed groups.</p> <p>GD – Measure the actual weight of the items (cross curricular maths)</p>
<p>Lesson 6</p> <p>LO: To understand how pulleys and gears</p>	<p>Sticky Knowledge: A mechanism allows a small force to move a larger object</p>	<p>Introduce pulleys and gears as alternative ways of using less force to move a greater mass. Show how pulleys and gear systems can be constructed.</p>

<p>allow a smaller force to have a greater effect</p> <p>Enquiry type Pattern Seeking</p>	<p>Pulleys, levers and gears are all mechanisms</p> <p>Focus skill Record data and results of increasing complexity using scientific diagrams and labels</p> <p>Record data and results of increasing complexity using tables</p>	<p>Construct structures with different numbers of pulleys between tables using a bamboo cane. Test how many newtons it takes to lift a 1kg weight using each pulley system.</p> <p>Gears toy to demonstrate – discuss bike gears. A small gear needs to work twice as hard because it needs to go around more times. Count how many times the small gear needs to move around when the large gear moves around once.</p> <p>Class split in half – half pulleys, half gears and then switch. Record photos on Twitter.</p> <p>LA – assisted ARE – Stick to fixed/moving/compound pulley GD – Challenge to create a complex pulley system</p>	
<p>Working towards</p>	<p style="text-align: center;">End of unit assessment</p> <p>Working at Age related expectations</p>		<p>Working at a greater depth</p>