Year 5 – Forces



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| National Curriculum Outcomes: Knowledge* 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, pullets and gears, allow a smaller force to have a larger effect
 | National Curriculum Outcomes: Working Scientifically* Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
* Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
* Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
* Using test results to make predictions and to set up further comparative and fair tests
* Reporting and presenting 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.
* Identifying scientific evidence that has been used to support or refute ideas or arguments.
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| Children might work scientifically by:Exploring paper cones or cup-cake cases, and designing and making a variety of parachutes and carrying out fair tests to determine which designs are the most effective. They might explore air resistance in water by making and testing boats of different shapes. They might design and make products that use levers, pulleys, gears and/or springs and explore their effects. (taken from the National Curriculum) |
| Links to prior learning**Year 3:** compare how things move on different surfaces. Notice that some forces need contact between two objects, but magnetic forces can act at a distance. Observe how magnets attract or repel each other and attract some materials and not others. Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials. Describe magnets has having two poles. Predict whether two magnets will attract or repel each other, depending on which poles are facing. | Links to future learning**KS3:** speed, balanced forces, moment the turning effect of a force, forces measured in Newtons |
| Key VocabularyForce, push, pull, gravity, friction, air resistance, water resistance, lever, pulley, gear, speed up, slow down, accelerate, decelerate | Common MisconceptionsChildren may think that the heavier the object, the faster it falls because it has more gravity acting on itSome children may think that smooth surfaces have no friction, or that objects will always travel better on smooth surfacesMany children think that heavy objects sink and light objects float* Children may think that a non-moving object has no forces acting on it
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| Important knowledge/facts that the children need to know* All forces are a push or a pull.
* Forces can be indicated with arrows showing their direction.
* On Earth, gravity is the force pulling all objects towards the centre of the Earth.
* Air resistance and water resistance are examples of friction.
* Air resistance causes objects moving through air to slow down.
* Water resistance causes objects moving through water to slow down.
* Friction is the force created by two objects, materials or surfaces rubbing together
* Friction causes objects to slow down or stop.
* Some forces are stronger than others and can overcome them when they are in opposition eg: gravity overcomes air resistance when a parachute falls to Earth.
* Levers, pulleys and gears can allow smaller forces to have greater effect.
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| Important Scientists**John McAdam –** Scottish civil engineer who tested different types of road surface to see which would be smooth, hard-wearing and have good water drainage **Isaac Newton –** English scientist who discovered gravity | STEM Career Links**Aeronautical engineer** (designs, develops, manufactures and maintains aircraft)**Pilot** (pilots planes) | Links to real life* Which shoes are the best for running?
* What part does friction play in our favourite sports?
* What if there was no friction/gravity/air resistance?
* How do astronauts carry out everyday tasks when there is no gravity?
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| Suggested Enquiry Activities |
| Identifying and Classifying* Sort actions we do each day according to the difference forces used.
 | Comparative and Fair Testing* How does the size of an object affect the rate it falls at?
* What is the best material to make a parachute out of?
* Which ball can bounce the highest?
* How does friction act differently on different things, e.g. shoes with different soles?
* How does water resistance act differently on differently-shaped objects
 | Observation over Time* Compare photographs of the class as babies to how they look now – how have they changed? What has stayed the same?
 | Pattern Seeking* Do heavier objects fall faster than lighter ones?
* Do heavier people fall further when they bungee jump?
 | Research using Secondary Sources* Where do you find gears in the real world?
* How was the theory of gravity developed?
* What are Heath Robinson and Rube Goldberg machines?
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| **National Curriculum Statements** | **Outdoor Learning Activities** |
| * 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.
 | It may be possible to drop parachutes, spinners etc. from a greater height safely outside e.g. from climbing apparatus.It may be more convenient to explore water resistance in the playground to avoid water on the floor in the classroom.Larger scale examples of levers, pulleys and gears can be explored outside. |

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| Wow Factor Experiences* Visit Isaac Newton’s childhood home (in Grantham) and see the apple tree
* Create parachutes for teddies
* Investigate bungee jumping using Barbie dolls
* Try the cross-curricular Squashed Tomato Challenge or Floating Gardens Challenge (see Helpful Weblinks area below)
* Apply forces learning to real life using the cross-curricular RAF Aiming for Awesome resources (see Helpful Weblinks area below)
* Investigate air resistance by creating bottle rockets
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| Maths Links* Investigate how far different numbers of elastic bands tied together can stretch then use this information to predict the best length for a bungee cord (made of the same elastic bands) for a thrill-seeking doll or action figure who wants to get as close to the ground as possible – then test by dropping him/her from a height!
 | Literacy Links* After investigating the best size/shape/material for a boat or parachute, write an explanation of why it was the best, explaining how the forces acted on it
 | Broader Curriculum Links**History:** How did people in the civilisation we are studying use levers, gears or pulleys to make their lives easier? **Geography:** How are different kinds of ship/boat shaped differently for exploring/travelling to different areas? |
| Story LinksThe Lighthouse Keeper’s Lunch – Rhonda & David ArmitageOld Bear – Jane Hissey (teddy parachutes)Up and Down – Oliver Jeffers |
| Helpful WeblinksTeacher CPD for Forces – <https://www.reachoutcpd.com/courses/upper-primary/forces-and-magnets/>Squashed Tomato Challenge - <https://practicalaction.org/schools/squashed-tomato-challenge/>Floating Gardens Challenge – <https://practicalaction.org/schools/floating-garden-challenge/>RAF Aiming For Awesome Activities - <https://www.tes.com/teaching-resource/raf-100-aiming-for-awesome-stem-resource-11905290>Bottle Rocket Instructions - <https://www.bbc.co.uk/teach/terrific-scientific/KS2/zr63d6f>Assessment exemplification (could also be useful with planning ideas) – <https://www.planassessment.com/product-page/examples-of-work-forces-y5-jimmy> BBC Class Clips (useful videos) – <https://www.bbc.co.uk/bitesize/topics/znmmn39>STEM Learning collection of resources for planning and teaching forces – <https://www.stem.org.uk/resources/community/collection/12696/year-5-forces> |

**NB**: This module should be taught before children have done the Year 5 work on **Earth & Space**. It may also be better taught after the unit on properties and changes of materials, as then learners can revisit irreversible changes by when creating bottle rockets.