

NC Purpose of Study

A high-quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

Intent	Implementation	Impact
At Broadway Junior School we believe that a high quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational 'Big Ideas', pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes. Science in our school is about developing children's ideas and ways of working that enable them to make sense of the world in which they live through investigation, as well as using and applying process skills. The staff here ensure that all children are exposed to high quality teaching and learning experiences, which allow children to explore their outdoor environment and locality, thus developing their scientific enquiry and investigative skills. They are immersed in scientific vocabulary, which aids children's knowledge and understanding not only of the topic they are studying, but of the world around them. We intend to provide all children regardless of ethnic origin, gender, class, aptitude or disability, with a broad and balanced science curriculum.	Teachers create a positive attitude to science learning within their classrooms and reinforce an expectation that all children are capable of achieving high standards in science. Our whole school approach to the teaching and learning of science involves the following: Science will be taught in planned and arranged blocks by the class teacher, to have a subject specific approach. This is a strategy to enable the achievement of a greater depth of knowledge. Through our planning, we involve problem solving opportunities that allow children to find out for themselves. Children are encouraged to ask their own questions and be given opportunities to use their scientific skills and research to discover the answers. This curiosity is celebrated within the classroom. Planning involves teachers creating engaging lessons, often involving high-quality resources to aid understanding of conceptual knowledge. Teachers use precise questioning in class to test conceptual knowledge and skills, and assess children regularly to identify those children with gaps in learning, so that all children keep up. Teachers build upon the learning and skill development of the previous years. As the children's knowledge and understanding increases, and they become more proficient in selecting, using scientific equipment, collating and interpreting results, they become increasingly confident in their growing ability to come to conclusions based on real evidence. Working Scientifically skills are embedded into lessons to ensure these skills are being developed throughout the children's school career and new vocabulary and challenging concepts are introduced through direct teaching. This is developed through the years, in-keeping with the topics.	The impact and measure of this is to ensure children not only acquire the appropriate age related knowledge linked to the science curriculum, but also skills which equip them to progress from their starting points, and within their everyday lives. All children will have: - A wider variety of skills linked to both scientific knowledge and understanding, and scientific enquiry/investigative skills - A richer vocabulary which will enable to articulate their understanding of taught concepts - High aspirations, which will see them through to further study, work and a successful adult life.

Key Vocabulary

Force, push, pull, gravity, gravitational force, mass, weight, friction, air resistance, water resistance, streamline, mechanism, lever, pivot, fulcrum, pulley, gear, surface, Newton (N), contact force, non-contact force, fair test, variable, prediction, conclusion

Knowledge	Skills
Children will know: - A force is a push or a pull. - Gravity is a force that pulls objects towards the Earth. - Friction acts between two surfaces. - Air resistance slows moving objects through the air. - Water resistance slows objects moving through water. - The amount of resistance depends on the shape of an object. - Mechanisms such as levers, pulleys and gears make work easier. - Forces can be measured and compared through investigation	By the end of the unit, pupils will be able to: - Explain the effects of gravity. - Compare the effects of friction on different surfaces. - Explain air and water resistance. - Carry out comparative and fair tests. - Record observations in tables. - Identify variables. - Draw conclusions using evidence. - Explain how simple mechanisms make work easier. - Use scientific vocabulary accurately.

Enrichment Opportunities

- Build marble runs using construction kits.
- Investigate playground surfaces.
- Water resistance investigation in a paddling tray.
- Visit a local playground to identify levers and pulleys.
- Design and race paper aeroplanes.
- DT link: design a vehicle with reduced friction.

Learning Objectives/End Points

Pupils will be able to:

- Explain that gravity pulls objects towards Earth.
- Describe the effects of friction.
- Explain air resistance and water resistance.
- Investigate forces scientifically.
- Explain how mechanisms make work easier.
- Draw conclusions using evidence from investigations.

Key Questions/Learning Objectives/End Points

To explain what forces are and understand gravity. Drop different objects and discuss gravity.	To investigate friction between different surfaces. Test toy cars travelling over different materials.	(TAPS Focused Assessment) To investigate how forces affect the movement of a marble. Marble Run investigation (TAPS).	To explain air resistance and water resistance. Compare parachutes and investigate streamlined shapes in water.	(TAPS Focused Assessment) To investigate water resistance. Aqua Dynamics investigation (TAPS).	To explain how mechanisms make work easier. Investigate levers, pulleys and gears using classroom equipment.
Starter (10 mins) Drop two different objects. Ask: Why did they fall? Could they fall upwards? Main (40 mins) Introduce forces as pushes and pulls. Explain gravity as a force acting towards the Earth. Demonstrate with a variety of objects. Children complete a sorting activity identifying pushes, pulls and gravity. Plenary (10 mins)	Starter (10 mins) Slide a book across a table. Ask: Why did it stop? Main (40 mins) Explain friction. Test toy cars travelling over different surfaces (carpet, paper, wood, sandpaper). Record distances travelled. Plenary (10 mins) Which surface created the most friction? Why?	Starter (10 mins) Demonstrate a marble run. Ask: What could make the marble travel further or faster? Main (40 mins) Complete the TAPS Marble Run investigation. Children: make predictions identify variables test different ramps or heights record results draw conclusions.	Starter (10 mins) Drop a flat sheet of paper and a crumpled paper ball. Ask: Why didn't they fall the same way? Main (40 mins) Teach air resistance. Demonstrate parachutes. Introduce water resistance using different shaped objects in water. Discuss streamlined shapes. Plenary (10 mins) Why are boats and fish streamlined?	Starter (10 mins) Show different shaped objects. Predict which will move through water most easily. Main (40 mins) Complete the TAPS Aqua Dynamics investigation. Children compare different shapes moving through water. Record observations and measurements. Draw conclusions using evidence. Plenary (10 mins)	Starter (10 mins) Show everyday examples: scissors wheelbarrow crane bicycle Ask: What do these have in common? Main (40 mins) Introduce levers, pulleys and gears. Children investigate simple mechanisms using classroom equipment.

True or False quiz about gravity.		Plenary (10 mins) Which variable had the greatest effect? Was your prediction correct?		Which design reduced water resistance the most? Why?	Identify where these mechanisms are used in everyday life. Plenary (10 mins) Exit Ticket: One mechanism I learnt about... One force I can explain... One investigation I enjoyed...
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Substantive Knowledge

- Gravity is a non-contact force acting between the Earth and objects.
- Friction acts between touching surfaces.
- Air and water resistance oppose motion.
- Streamlined shapes reduce resistance.
- Mechanisms transfer force to make work easier.
- Scientific investigations help us understand force

Careers

Linking Curriculum Learning to Careers

Discuss how the skills developed in this unit are used in a range of careers, including:

- Mechanical Engineer
- Civil Engineer
- Aerospace Engineer
- Automotive Engineer
- Structural Engineer
- Design Engineer
- Vehicle Designer
- Vehicle Technician
- Motorsport Engineer
- Aeronautical Engineer
- Aircraft Technician
- Train Engineer
- Rail Engineer
- Robotics Engineer
- Sports Equipment Designer
- Physiotherapist
- Sports Coach
- Exercise Scientist

Transferable skills such as Curiosity Observation Investigation Problem solving Teamwork Communication Research Organisation Attention to detail Classification Data handling Critical thinking Decision making Creativity Resilience Responsibility Confidence

Learning from Career and Labour Market Information

- Introduce pupils to careers involving forces and movement, including engineers, vehicle designers, architects, construction workers, mechanics, aerospace professionals and sports scientists. Explore how these careers contribute to everyday life and technological development.
Addressing the Needs of Each Pupil
- Provide varied opportunities to explore careers through practical investigations, building challenges, teamwork, modelling and problem-solving. Recognise that different careers require different strengths, including practical, mathematical, creative, technical and communication skills.
Linking Curriculum Learning to Careers
- Explicitly link gravity and forces to physicists and engineers; friction and resistance to mechanical and automotive engineers; streamlined shapes to aerospace, marine and automotive engineers; levers, pulleys and gears to mechanical engineers and technicians; and investigation and testing to product designers and engineering scientists.
Encounters with Employers and Employees
- Invite an engineer, mechanic, vehicle designer, construction worker, sports scientist or technician to speak to pupils. Pupils could prepare questions about their role, equipment, workplace, qualifications and how they use forces and problem-solving.
Experiences of Workplaces
- Explore photographs, videos or virtual tours of engineering workshops, construction sites, automotive factories, shipyards, sports science facilities, aircraft hangars and design laboratories. Identify where forces and mechanisms are used in each workplace.