Science Autumn 2 Year 5 (LTP) **Forces**

Domains
Forces

Animals Including Humans	
Prior Learning	**Future Learning** Children do not need to be taught this year
Year 4 • Compare how things move on different surfaces. (Y3 - Forces and magnets) • Notice that some forces need contact between two objects, but magnetic forces can act at a distance. (Y3 - Forces and magnets) • Observe how magnets attract or repel each other and attract some materials and not others. (Y3 - Forces and magnets) • 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. (Y3 - Forces and magnets) • Describe magnets as having two poles. (Y3 - Forces and magnets) • Predict whether two magnets will attract or repel each other, depending on which poles are facing. (Y3 - Forces and magnets)	Year 6 • Forces as pushes or pulls, arising from the interaction between two objects. (KS3) • Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces. (KS3) • Moment as the turning effect of a force. (KS3) • Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water. (KS3) • Forces measured in Newtons, measurements of stretch or compression as force is changed. (KS3)
In Year 5 NC Objectives	
• 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.	
Key Learning	**Possible Evidence of Secure** (Shows understanding of a concept using scientific vocabulary correctly)
A force causes an object to start moving, stop moving, speed up, slow down or change direction. Gravity is a force that acts at a distance. Everything is pulled to the Earth by gravity. This causes unsupported objects to fall.	• Can demonstrate the effect of gravity acting on an unsupported object • Can give examples of friction, water resistance and air resistance • Can give examples of when it is beneficial to have high or low friction, water resistance and air resistance • Can demonstrate how pulleys, levers and gears work

Air resistance, water resistance and friction are contact forces that act between moving surfaces. The object may be moving through the air or water, or the air and water may be moving over a stationary object. A mechanism is a device that allows a small force to be increased to a larger force. The pay back is that it requires a greater movement. The small force moves a long distance and the resulting large force moves a small distance, e.g. a crowbar or bottle top remover. Pulleys, levers and gears are all mechanisms, also known as simple machines.	
Common Misconceptions	**Vocabulary**
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.	Force, gravity, Earth, air resistance, water resistance, friction, mechanisms, simple machines, levers, pulleys, gears Enquiry vocabulary: question, answer, explore, prediction, equipment, biology, chemistry, physics, enquiry, comparative, fair tests, relevant questions, scientific enquiry, plan, variables differences, similarities, changes, careful observation, gather, record, classify, present, systematic, accurate measurements, accuracy, precision, repeat readings, quantitative measurements construct, interpret, evidence, conclusion, causal relationship, explanations, degree of trust, patterns improve, support, refute, arguments, **What would you like to find out?** **Look – observing** **book - asking expert** **and test – fair testing** **Plan, do, review – planning others- test children have done**
Sticky Knowledge	**Key Questions**

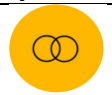
• Air resistance and water resistance are forces against motion caused by objects having to move air and water out of their way. • Friction is a force against motion caused by two surfaces rubbing against each other. • Some objects require large forces to make them move; gears, pulley and levers can reduce the force needed to make things move	• What actually is a force? • How can a force act on an object? • How can we see forces? • How can we measure forces? • How does the saltiness (salinity) of water affect the water resistance? • How does the length of a piece of a paper helicopter's wings affect the time it takes to fall? • How does the changing the shape of a piece of plasticine affect water resistance? • How does adding holes to a parachute affect the time it takes to fall? • How does the amount/depth of tread affect the friction between a shoe and a surface? • How can we use levers to lit more? • What is the most effective way to move an object? • How do see-saws work? • Can you create a pulley system to life a given load?

Pre-Topic Assessment Resources

Explorify – filter for y5-6 and Forces - *relevant Odd one Out, What's Going on?*
Explore, Engage, Extend (EEE) by PSTT:
– Copy of activity instructions
-Cards downloaded from website https://www.pstt.org.uk/eee-resources
-Copy of Challenging Misconceptions
-Children's Questions

Working Scientifically (Apply knowledge in familiar related contexts, including a range of enquiries)	**Possible Evidence of Secure**
1. Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary 2. Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings where appropriate 3. Ask people questions and use simple secondary sources to find answers 4. Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs	• Can explain the results of their investigations in terms of the force, showing a good understanding that as the object tries to move through the water or air or across the surface the particles in the water, air or on the surface slow it down

5. 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 6. Use test results to make predictions to set up further comparative and fair tests -Identify scientific evidence that has been used to support or refute ideas or arguments Highlighted yellow = main focus during this topic	• Can demonstrate clearly the effects of using levers, pulleys and gears
Pupils could work scientifically by: • Investigate the effect of friction in a range of contexts e.g. trainers, bathmats, mats for a helter-skelter. • Investigate the effects of water resistance in a range of contexts e.g. dropping shapes through water and pulling shapes, such as boats, along the surface of water. • Investigate the effects of air resistance in a range of contexts e.g. parachutes, spinners, sails on boats. • Explore how levers, pulleys and gears work. • Make a product that involves a lever, pulley or gear. • Create a timer that uses gravity to move a ball. • Research how the work of scientists such as Galileo Galilei and Isaac Newton helped to develop the theory of gravitation.	

Fair/Comparative testing- T	Identify & Classify L	Observation over time B	Pattern Seeking L	Research B
				
How does the angle of launch affect how far a paper rocket will go? **How does the surface area of an object affect the time it takes to sink?** Which seed shape takes the longest time to fall? Which shoe is the most slippery?	Can you label and name all the forces acting on the objects in each of these situations?	How long does a pendulum swing for before it stops?	Do all objects fall through water in the same way?	How do submarines sink if they are full of air?

Which shape parachute takes the longest to fall?				

How Science Ideas Have Changed Over Time
How have our ideas about gravity changed over time?

Assessments	**Key Scientists**
TAPS **Spinners** •Can children improve accuracy by repeating measurements? •Can children identify patterns in results? **Focus – Do (Observe and Measure)** Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate **Aqua dynamics** •Can children use test results to make predictions relating water resistance to surface area? •Can children identify variables which may affect the results? **Focus – Review (Evaluate)** Explain degree of trust in results. Identify and evaluate scientific evidence (their own and others') that has been used to support or refute ideas or arguments. **Concept Cartoons** **PLAN Assessments**	Galileo Galilei – gravity & acceleration (also Earth in Space) **SOTSOG** Helen Margolis – Contemporary **SOTSOG** https://www.pstt.org.uk/SOTSOG-resources Sir Isaac Newton (1642 – 1727) – Formulated the laws of motion/ gravity Christopher Cockerell (1910- 1999) – Inventor of the hovercraft Archimedes of Syracuse - levers John Walker (The Match)

Linked Texts	**Science Capital**	**Maths**
Leonardo's Dream (Hans de Beer) The Aerodynamics of Biscuits (Clare Helen Welsh) The Enormous Turnip (Katie Daynes)	Complete this section as you do your medium term plans. How can science be made relevant to all the children so that they enthusiastically engage with science now and in the future. Link to their own experiences and interests. Use children's observations and questions.	• ruler, tape measure or trundle wheel, force meter with a suitable scale. • They record measurements e.g. using tables, tally charts, bar charts, line graphs and scatter graphs. They record classifications e.g. using tables, Venn diagrams, Carroll diagrams and classification keys. • Introduce finding percentages, use decimals

History Links

Vikings – Boats/ long boats – sinking etc What surfaces are best for pulling across water? How does the weight of the object effect how hard it is to pull it across the water? Vikings played games to show their strength and might. Tug of war – how is this effected by force? Describe the balance and imbalance of a Viking show of strength of lifting heavy logs
Planning Resources
PSTT ASE STEM Standing on The shoulders of Giants SOTSOG (PSTT) Hamilton Trust Ogden Trust Explorify

Session 1 WALT- understand what a force is and identify forces acting on an object	
Retrieval activity	Yr3 magnets concept cartoon
Lesson	Starter- chn to each have a go at the retrieval activity in their books. Explain this is learning from year 3 but will help us when we do our learning this term. Teacher to go through ideas with chn. Use starter as an assessment opportunity. Do not show PPT or WALT until this video-- https://www.bbc.co.uk/bitesize/clips/zp4g9j6- show this video and ask the chn what is happening here. What is each object doing? Look for the words moving or pushing and pulling, Introduce our learning this half term with reference to the WALT. Teacher to go through PPT. Chn to come up with their own definition of what a force is and this is to be written on the working wall. Using the examples on the PPT children to act out the forces with pairs. Show the force acting against each other. Explain that some forces could be useful (air resistance with a parachute) or not useful (friction) as this makes it harder for the person pedalling a bike. Task- Chn to have differentiated sheets to have a go at what forces are acting on each example. Teacher to put some examples on the working wall to remind children which forces are acting on objects.
Key vocabulary	Forces, air resistance, gravity, push, pull, independent, dependent, controlled
Differentiation	Differentiated sheets, differentiated groups
Assessment	Can chn identify the forces acting on objects?
Session 2. WALT- Explain the effect of gravity and understand key vocabulary	

Retrieval activity	On whiteboards- can chn identify the order of the planets in our solar system
Lesson	Chn should do retrieval activity as a starter. On PPT- Show chn talking about why the ball is falling to the ground. Encourage a discussion on tables for chn to think about which one is true and why. Show the next slide identify that the boy was correct. Gravity pulls the ball downwards. Discuss that Gravity is acting on all of us, keeping as on the ground rather than floating. Explain that the as we learnt last lesson all objects product some level of air resistance otherwise they would all fall to the ground at the same time. Introduce Isaac Newton. Ask chn if they know anything about him or why we would be talking about him? Add to working wall. Introduce the terms mass and weight. Explain to chn that these are often used incorrectly. Eg how much do you weigh? Task- Chn to use Newton Metres to measure the pull on different objects around the room. They are to produce a table showing the object and how many newtons it was.
Key vocabulary	Gravity, Isaac Newton, Newton Metre, Air resistance, force
Differentiation	SEN have help drawing the table
Assessment	Can chn identify who Isaac Newton is and what gravity is
Session 3. WALT- To understand the effects of air resistance on objects	
Retrieval activity	On whiteboards- draw an object and write what forces are acting on the object.
Lesson	Chn to do retrieval activity as a starter on whiteboards. Reintroduce the terms force, air resistance, gravity and friction. Talk chn through the ppt, discuss the hammer and the feather. And have a conversation about it is the air resistance acting on the feather which means it falls to the ground at a slower rate. https://youtu.be/oYEgdZ3iEKA - show video of hammer and feather on the moon. Why did this happen? Explain to the chn that if it wasn't for air resistance acting on objects they would all fall to the ground at the same time, no matter their mass. Discuss how air resistance can sometimes be useful and sometimes it may not be, use the idea of cycling and running to help support this concept. Discuss the idea that next lesson we will be making different parachutes to try and make the biggest air resistance. Discuss what we could change to the parachute to try and make the biggest air resistance- eg, object attached, size of material, material. In their groups chn are to decide what they would like to change (independent variable) They are to decide all the things they would need to keep the same (controlled) and the thing they would be measuring (dependent). They are to write these in their books. They can come up with a prediction and write this in their book- eg the bigger the material, the slower the parachute will be. They could draw the table in their books in preparation for the next lesson.
Session 4. WALT- To carry out an experiment on the effects of air resistance	
Retrieval activity	On whiteboards- write what air resistance is, how it can be good and how it can be bad
Lesson	Chn to do retrieval activity on whiteboards as a starter. Chn to have a look in their books at their controlled, independent and dependent variables and remind themselves what they are investigating.

	Chn to work in their groups to make the parachute following the instructions. In their groups they are to test their parachutes to see how long it takes to fall (class to decide on the height for fall and stopwatches to be used) Fall to be repeated (discuss with chn why this is) Chn to come back together and discuss what they have found out. Write a sentence about whether their prediction was correct and why this was.
Session 5. WALT- To understand what is meant by friction	
Retrieval activity	On whiteboards- what does force mean
Lesson	Chn to do retrieval on whiteboards as a starter Talk through slide on children discussing what friction is and have a class discussion about which child they think is correct. Go through answers. Get children to rub their hands together as fast as they can explain that this is showing friction and they will notice their hands are now hot Go through some examples when friction is helpful and some when it is unhelpful. Link back to the picture of bikes, boy pulling cart Ask chn what an independent, dependent, controlled variable is. Explain that we are investigating how friction affects movement We will be moving a trainer across different surfaces and measuring how the amount of force changes. Children should make a prediction about what surface will produce the smallest force and be the easiest to pull across. Chn to draw a table to display results Write a sentence about whether their prediction was correct