

Year Group	5
Term	Spring 2
Subject	Science

Topic	Forces
Curriculum Intent	To use scientific skills to investigate forces

Key Vocabulary	Force, friction, gravity, variables, prediction, weight, mass, pulleys, gears, Newton
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Skills	- 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 - recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and bar and line graphs - using test results to make predictions to set up further comparative and fair tests - reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of results, in oral and written forms such as displays and other presentation - identifying scientific evidence that has been used to support or refute ideas or arguments.
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Knowledge	Pupils will know that: - unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object - the effects of air resistance, water resistance and friction, that act between moving surfaces - some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect - scientists such as Galileo and Newton helped to develop the theory of gravitational force.
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Spring 1 MTP				
Week	Learning Objective	Activities	Differentiation	Outcome
1	To explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object Resources needed: Slides • Worksheets 1A/1B/1C • Large trays, flour, cocoa/chocolate powder, marbles, ball bearings, golf balls etc	What is weight? Children to think, pair, share their ideas. • Explain that weight describes how heavy an object is and that it is Earth's gravitational force that causes objects to have weight. Explain that gravity is a force that pulls objects towards the Earth's centre. Look at the diagram of clouds placed around the globe. Which way will the rain fall? Invite children to come to the board to draw in the rain and then check if they were right by looking at the diagram and explanations on the next slides. • Show children a video of astronauts walking on the moon (e.g: http://www.youtube.com/watch?v=nGMEn0FFQvw). Why are these astronauts bouncing instead of walking? Explain that the gravitational force on the moon is weaker than on Earth. Earth's gravitational force is six times stronger. What do you think it would feel like to walk on the moon? Invite children to share their ideas. • Explain that one of the ways we can see the effect of gravity is by looking at craters left in the ground by meteorites that have landed. How might the shape and size of a meteorite affect the shape and size of the crater that it leaves in the ground on impact? Children to think, pair, share their ideas.	Can children explain why objects fall towards the centre of the Earth? Do children understand the causal link between the mass of an object and the amount of force with which gravity acts on it?	In groups, children are to measure the craters caused by dropping objects of different weights into a tray of flour as described in the slides. Using worksheet 1C as a guide, they are to record their observations, draw conclusions and explain causal links between the weight of the objects and the shape/size of the craters they create.

		• Explain how the depth of crater and amount of material scattered is dependent on the weight of the meteorite (the size of the meteorite mainly affects the diameter of the crater). • Explain how to use a tray of flour and objects of different weights to explore the effect of gravity on falling objects by measuring craters.		
2	To identify the effects of friction acting between moving surfaces. Resources: • Slides • Worksheets 2A/2B/2C/2D • Forcemeters • Variety of surfaces to test	Show children pictures where friction is affecting the movement of an object; which of the statements surrounding the pictures do children agree or disagree with? Why? • Explain that to make an object move on a surface you need to either push it or pull it, and that there is a force between the surface and object that may make it harder for the object to move. What is this force called? • What is friction? Children to discuss their ideas and then write a definition as a class. Check the definition on the slides to see if they were correct. • Explain that any object or surface that moves across another object or surface has friction but that sometimes there is lots of friction (high friction) and sometimes there isn't much friction at all (low friction). • Show images depicting instances of high friction and low friction. Which would have less friction and be easier to move? Why? Can you think of	Can children define friction? Do children know that friction can be useful and give some examples? Can children carry out an investigation, making sure that it is a fair test?	Using worksheet 2C as a guide, children to plan their own experiment to find out how the friction between an object and a surface differs when the surfaces are different. Children to plan their experiment and then carry it out using the relevant equipment. EXTEND - challenge children to present their results as a bar graph.

		any more examples of high and low friction? List ideas on the slides. • Show children the picture of a forcemeter (or have some forcemeters to pass around). Do you know what this is? What does it do? How does it work? Children to share their ideas. • Show a list of different surfaces, e.g. tarmac, cardboard, carpet. How could we plan an investigation to find out which of these surfaces has the most friction and so would make moving an object on it the most difficult? Children to think, pair, share their ideas and then go through the suggestions on the slides. • How would we make this experiment a fair test? Again, children to discuss ideas, then go through the suggestions on the slides.		
3	To identify and explain the effects of air resistance Resources: • Slides • Worksheets 3A/3B/3C/3D • Plastic Bag Parachute sheet • Plastic bags, string/wool, paper clips, rubber bands	Have you ever walked outside on a really windy day? What did it feel like? How easy was it to walk? • Explain what air resistance is and use different examples to show this, e.g. parachutes, kites etc. • Explain that the size of a surface affects how fast it will move through the air because air resistance acts against it and slows it down. Which of these two objects do you think will fall to the ground quicker and why? Invite children to share their ideas. • Show picture of a sky diver. Explain that a parachute saves the sky diver's life because the air resistance acts against the gravitational force	Do children know that air resistance is a force that slows objects moving through the air? Can children plan, carry out and assess experiments to investigate air resistance? Can children draw conclusions from their investigations?	In groups, children are to discuss how best to plan, carry out and evaluate an experiment to see if the size of a parachute affects how long it takes to fall. They are then to complete the plan and carry out the experiment by following the instructions on the Plastic Bag Parachute sheet and testing the speed at which different sized parachutes fall.

		and slows the sky diver down so he can land safely. Which of the statements surrounding the next picture of a sky diver do children agree with? Why? Which is most scientific? Can children suggest improvements to any of the statements?		
4	To identify and explain the effects of water resistance. Resources: • Slides • Worksheets 4A/4B/4C/4D • Measuring cylinders or equivalent • Water • Plasticine • Stopwatches	What does it feel like to walk in water? How is it different to walking on land? Children to think, pair, share their ideas. • Establish that it is more difficult to walk in water than on land. Why do you think boats and fish are able to move easily in water? Again, children to think, pair, share their ideas. • Explain what water resistance is and how different shapes move with different ease in water. Show children the two objects on the slides. Which of these do you think would fall to the bottom of this container of water quicker and why? Children to share ideas, giving reasons for their choices. • Tell children that they will be carrying out an investigation to find out how different shapes move in water. How do you think we could do this? How would we make sure it is a fair test? How will you record the results? Discuss ideas and then go through the suggestions on the slides.	Do children know that water resistance slows an object moving through water? • Can children plan and carry out an experiment, making sure it is a fair test? • Can children identify trends in results and draw conclusions?	Children to finish planning the experiment using worksheet 4B as a guide and then carry out the experiment with a cylinder of water and a piece of plasticine, recording the results and conclusion on the worksheet.
5	To recognise that levers and pulleys allow a smaller	Show an image of a heavy object. What could be used to make lifting the object easier? Children to think, pair, share their ideas.	Do children recognise that levers and pulleys allow a small force to	Children are to try each of the methods of lifting a bottle using pulleys as instructed. They are then to draw and fill out a

	force to have a greater effect. Resources: • Milk/water bottles with handles • String, cord or thin rope • Broomsticks or thick dowel rods	• Explain that a pulley could be used to lift the object. Go through the explanation on the slides about how pulleys are useful and when they were first used. • Belt pulleys are used in lots of different machines to make it easier to lift or move heavy objects. Belt pulleys today have motors that use a small amount of force to lift or move very heavy things. Can you think of any machines that use pulleys? Children to share their ideas, then go through the suggestions on the slides. • Go through the explanations of levers on the slides and how they are an example of a simple machine. • Show the slides illustrating how levers are used to lift and move objects. Children can try out using a simple lever and fulcrum to lift objects as described. Explain that levers have been used since ancient times, especially in warfare. • Explain that today we will be exploring ways in which simple machines using levers and pulleys allow a smaller force to have a greater effect.	have a greater effect? • Can children make and improve models that use pulleys or levers? • Can children explore the effects of changing parts of their model?	table to show what they have learned.
6	To recognise that gears allow a smaller force to have a greater effect. Resources:	Gears (sometimes called cogwheels) are wheels that have 'teeth'. When the teeth of two or more gears mesh together, force can be transmitted from one gear to another. Go through the slides explaining the names and parts of a simple, two gear transmission. What will happen when the driver gear turns? Children are to discuss and share their ideas about each transmission shown;	Do children recognise that the speed or amount of force transmitted is affected by changing the size of the gears in a	Stick the Cut-out Gears sheet onto thick corrugated cardboard or foam artboard. Following the instructions on worksheet 6B, children are to carefully cut out the gears required to

	• Slides • Worksheets 6A/6B/6C • Cut-out Gears	the following slides show what will happen. Were you correct? • There are lots of different types of transmission. All of them are designed to help us transmit force from one place to another or use a small amount of force to have a greater effect. Explain how the gear ratio on a bicycle allows us to transmit a small amount of force from the pedals to the wheels where the effect is greater. • Show the slides with images of different gear ratios. How will the speed and amount of force change? Children are to discuss and share their ideas about each transmission shown; the following slides show what will happen. Were you correct? • Bevel gears, rack gears and worm gears allow force to be transmitted in different directions. Do children recognise the worm gears shown? The following slides show how these gears work. • Explain that today we will be using gears to make different types of transmission.	transmission? • Can children make transmissions where two or more gears work together?	make the transmissions shown. They are then to answer questions about the transmissions they have made.
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