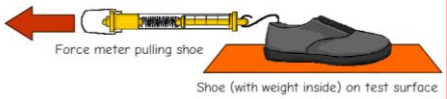
Unit plan – Year 5 Spring 2 (Forces)

	Concept	Subject Skill (Learning Objective)	Subject Knowledge	Pedagogical Content (how you will teach)
	Forces Working Scientifically	<u>Lessons 1-5</u> I am learning to identify the effects of air resistance, water resistance and friction, that act between moving surfaces I am learning to plan different types of scientific enquires to answer questions, including recognising and controlling variables where necessary I am learning to take measurements, using a range of scientific equipment, with increasing accuracy and precision I am learning to record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graps I am learning to report and present findings from enquires, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms	I know that friction is a force between two surfaces that are sliding/moving across each other I know that friction can be helpful and unhelpful and can give some examples of this. I know that frictional forces slow down the movement of an object I know that air resistance and water resistance are frictional forces that acts on an object travelling through the air or water	**Lesson 1 & 2** What is friction? How can friction be helpful/unhelpful? Explain that our topic for this half term is 'What a wonderful world!' We have already thought about a force that acts on our wonderful world- what is that force? Recap gravity from Autumn 2. Explain that this week, we will be learning about other forces that we encounter in our world. Ensure children are confident in the definition of a force: a force is a push or a pull that acts on an object due to the interaction with another object. Force is measured in Newtons (N). Today, we are going to be learning about the effect of friction. Ask the children to share any ideas they may have already about what friction is/where they may have experienced it. Explain that friction is a force between two surfaces that are sliding, or trying to slide, across each other. For example, when you try to push a book along the floor, friction makes this difficult. Friction always works in the direction opposite to the direction in which the object is moving, or trying to move. Friction always slows a moving object down. Watch the clip on the following link to support explanation. Friction - BBC Bitesize After the video, ask the children to think again, about where they may have experienced helpful or unhelpful friction. For example, they could think about why they have to take their shoes and socks off for PE in the hall. This is an example where friction is a helpful force to us. Introduce the investigation question: **Which material would make the best floor surface to stop people from slipping?** *How could we test this*? Plan together the investigation, ensuring that the children plan their variables in order to ensure it is a fair test (see example document in your resource folder). **You will need:** • A shoe (a pump or plimsoll is ideal) • A 1kg weight (to weigh down the shoe) • A carpet tile • A wooden board • A sheet of paper • A plastic sheet (a bin liner is ideal) • A force meter **Method** Set up the apparatus as shown in the diagram. Predict the force needed to make the shoe slide along the surface of your desk. Gradually pull on the force meter until the shoe starts to slide. Record the measurement on the force meter on the results table. Repeat the investigation on top of the carpet tile, wooden board, sheet of paper and bin liner. Fig.1 - How to set up the investigation  Before carrying out the experiment, it would be beneficial to spend some time looking at the force meter and discussing any questions chn have. Please note that some of the force metres do have different scales Children to use the table provided in your resource folder to make predictions and to record their findings. Children to present their results in a bar chart (template included in your resource folder) Children to conclude their findings with a written explanation of what their results show, linking back to the investigation question. You could use the following as prompts for discussion: *How accurate were your predictions? How fair was our test? How could we make it fairer? Which material had the biggest friction force? Which material had the smallest friction force? Can you place the materials in order of size of friction force? Which material would make the best floor covering? Why?* <u>Lesson 3-4</u> What is air resistance? Explain that we are going to be looking at another force today, which is a type of friction- air resistance. Use the PPT to explain air resistance, and how this was discovered. The PPT begins by referring to gravity (prior learning) and how this helped to prove air resistance is a force on our world. Explain that we are going to consider the effect of air resistance by investigating if the size of a parachute will affect how fast it will fall. *How could we do this?* Children to plan the investigation, considering the variables they will need to keep the same or change.

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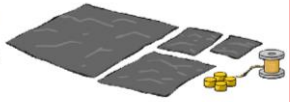
				You will need: • A black bin liner cut into 4 different squares - 10cm x 10cm, 20cm x 20cm, 30cm x 30cm, 40cm x 40cm • String • 4 x 50g weights • A stopwatch • A calculator (for finding the mean)  **Method** Create 4 parachutes, each made up of a canopy, 4 lengths of string and a 50g weight.  Predict and then test how long it will take each parachute to reach the ground when dropped. Use the stopwatch to measure this time in seconds to one decimal place. Test each parachute 3 times. Record the time taken to descend to the ground on the results table. Children to record their results in the table provided in your resource folder. They should calculate the mean time for each parachute, and then present this time on the bar chart provided. Children to conclude their findings with a written explanation of what their results show, using key scientific vocabulary. They should also refer to the causal relationship between the canopy size and the rate of descent. You may wish to discuss any anomalies in their data, discussing what this means and why this may have happened, e.g. not pressing the timer quick enough, or hesitating before letting the parachute go. They may wish to address this in their conclusion about how to improve the accuracy of their results next time. You could also use the following prompts to support discussion of their findings: *How fair was your test? Can you place the parachutes in order of effectiveness? What is the relationship between canopy area and parachute effectiveness? Can you explain this?* <u>Lesson 5</u> What is water resistance? Recap previous learning about friction and the frictional force air ressitance. Today, we will be earning about the effect of watere resistance. Use the PPT to introduce water resistance and explain how it works. Children to investigate water resistance through dropping different shapes in to water, to see how fast they travel in the water. Children should identify from this that streamlined shapes have less water resistance. An example of this investigation can be seen here (1.45min onwards) https://www.youtube.com/watch?v=a85Qepkt6J0 Take some images of children observing this investigation. Put these images in books and get chn to write an explanation of what they discovered (What water resistance is and does, which shapes worked better and why). You can use IPADS to record video of objects falling through water to watch and discover results.
	Forces Working Scientifically	<u>Lessons 1- 5</u> I am learning to recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect I am learning to plan different types of scientific enquires to answer questions, including recognising and controlling variables where necessary I am learning to take measurements, using a range of scientific equipment, with increasing accuracy and precision I am learning to record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graps I am learning to report and present findings from enquires, including	I know that mechanisms are machines that allow us to use a smaller force to have a greater effect I know how levers use a small force to have a greater effect I know examples of how levers are used in the world	**Lesson 1 & 2** What are levers and why are they helpful? Start the lesson by recapping last week's learning by giving the children the forces example diagrams. They will need to write the missing names of the forces (they could write push or pull as well if unsure on some of the names) Explain that this week we are going to be exploring how we use forces are every day in our wonderful world through…mechanisms. You could use this clip to introduce what mechanism are: https://www.bbc.co.uk/teach/class-clips-video/science-ks2-mechanisms/zfhr96f Explain that mechanisms, including levers, pulleys and gears, allow us to use a smaller force to have a greater effect and change in motion. For example, a bicyle. We sit and push on the pedals moving our legs in a circular motion, tese are our input forces, and this drives us forward (output) must faster than we can run and with much less effort. This week. We will investigate what these machines are and how they make life easier for us. Introduce KQ and explain that we will be investigating levers first. Using the levers diagram in your resource folder, explain that a lever is one of the oldest and simplest machines used by humans. A lever consists of just two parts - a beam (the long part) and a fulcrum or pivot (hinge). The beam rotates (turns) along the fulcrum. Levers are useful because they allow humans to lift heavy weights by applying a smaller force. Use the lever example document to show how levers are used in the world around us. Ask the children if they think they can think of any of their own examples. To investigate further, children to carry out the following investigation:

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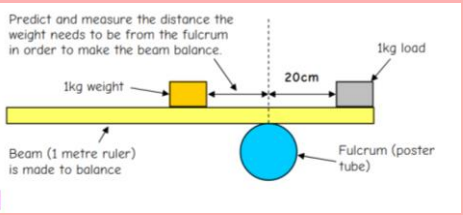
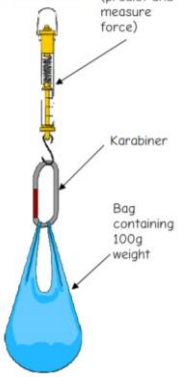
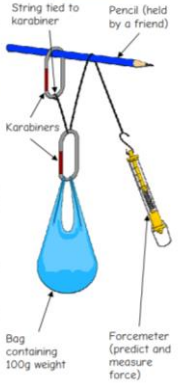
		conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms		**Investigation** How can we lift a 1kg weight using a lever? **You will need:** • 1 x 1kg weight (to act as the load) • 10 x 100g weights (to create a range of forces) • A 1 metre ruler (to act as the beam) • A suitable fulcrum (such as a poster tube) **Method** Set up the apparatus as shown in the diagram. Place the 1kg load at one end of the ruler. Place the fulcrum 20cm from the load. Predict and then measure how far a 1kg weight needs to be from the fulcrum in order to make the beam balance. Record your prediction and measurement in the table. Predict and then measure how far a 900 weight needs to be. Repeat with 800, 700, 600, 500, 400, 300, 200 and 100g weights.  Children to record their predictions and results in the table provided. Then, children to present their findings using the line graph template provided. Children to conclude their findings with a written explanation of what their results show, using key scientific vocabulary. Use the following prompts to support this: *How accurate were your predictions? What happened to the distance the weight needed to be from the fulcrum as the size of the weight decreased? How far did the 1kg load move? How far did the weights, which you added, move? Can you explain how the lever works?*
			I know how pulleys use a small force to have a greater effect I know examples of how pulleys are used in the world	Lesson 3 What are pulleys? How do they reduce the force needed to lift a load? Explain that pulleys are simple machines, which allow us to lift weights using less force. It can also be used to change the direction of a force. You could use the following video to support explanation: https://www.youtube.com/watch?v=LiBcur1aqcg Show the children the real life examples of where pulleys are used in our world. Children to investigate pulleys through exploring the force needed (in Newtons) to lift a load with an without a pulley system. There are instructions on how to create a simpler pulley system in your resource folder, or you use the following method: A **pulley** is a simple machine which allows us to lift weights using less force. It can also be used to change the direction of a force.  **Scientific question** How does using a pulley reduce the force needed to lift a load? **You will need:** • 2 karabiner clips • A plastic bag • A pencil or stick • A force meter • Strong string • Scissors • A plastic bag **Figure 1**  **Measurement 1 (figure 1)** Attach the bag to a karabiner. Attach the other end to the force meter Calibrate the force meter to make sure that it reads 0. Predict and then measure the force that a 100g weight will produce when placed in the bag and hung from the force meter. Record your prediction and measurement on the results table. **Measurement 2 (figure 2)** Create a simple pulley as shown in the diagram. Predict and then measure the force that it will require to lift a 100g weight using the pulley. Record your prediction and measurement on the results table. Repeat with 200g, 300g, 400g, 500g, 600g, 700g, 800g, 900g and 1kg with and without the pulley. **Figure 2**  Children to record their findings for the force needed for lifting different loads with and without a pulley system. You may choose to do less different loads than in the investigation given. They should record their results in a table like the example in your resource folder, and then present their findings using a line graph like the template provided. Children to conclude their findings with a written explanation of what their results show, using key scientific vocabulary. Use the following prompts to support this: *Is more or less force needed to lift a load with the help of a pulley? What is the relationship between the force needed to lift a load with a pulley and the force needed to lift it without a pulley? Can you explain this?*
		DT Link I am learning to make a product using a pneumatic system	I know how gears use a small force to have a greater effect I know examples of how gears are used in the world I know that pneumatics are a form of mechanism that use air to create a force	Lesson 4 What are gears? Use the following clip to introduce gears as another mechanism in which it allows use to use a smaller force to have a greater effect. https://www.youtube.com/watch?v=-m3Er8Zcb_A Explain that gears are used in many different types of machinery, ranging from cars, to watches, to windmills, to pencil sharpeners. Gears let us control how quickly and in what direction something rotates. Children to use the making gears document template to create their own gears. Take photos and children to explain in their books how the gears worked. Lesson 5 Where else in the world do we use forces for our benefit? What are pneumatics?

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				Begin the lesson by recapping the three types of mechanisms we have identified this week and how they use a smaller force to have a greater effect. You could use the pulley,lever or gear activity to support this. Use the PPT to introduce pneumatics as another type of mechanism used in the world around us. The PPT includes real life examples. Chidlren can then explore this using the pneumatic monster activity. Plenary- Discuss with children their findings from this unit, about how forces can be helpful and unhelpful, and how we can utilise forces through mechanisms in order to enable us to make different tasks easier for ourselves.

Vocabulary

Support, fall, gravity, air resistance, friction, balancing force, Newtons, force, variables, moving, surfaces, causal , relationships, water resistance, levers
weight, newtons, resistance, moving,
causal relationships, water resistance, mechanisms, levers, pulleys, transfers, measurements, conclusions, scientific, diagrams, labels, tables, line graphs

Resources.
Week 1
Lesson 1- shoe, 1kg weight, carpet, wood, paper, bin liner, force metres
Lesson 3- bin liners, 4x 50g weights, stopwatches, calculators
Lesson 5- empty bottles or tubs, water, playdough or small 3D shapes
Week 2
Lesson 1- 1kg weight, 10 x 100g weights, metre rules, poster tubes
Lesson 3- karabiner clips, plastic bag, pencil or stick, force meters, strong string, scissors, 100g weight
Lesson 4- cardboard, scissors,
Lesson 5- card