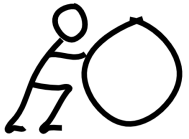
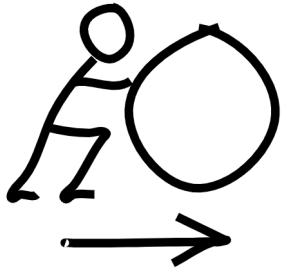
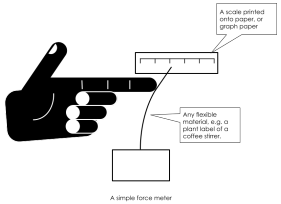
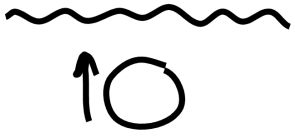
Progression Map for Forces

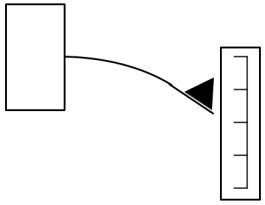
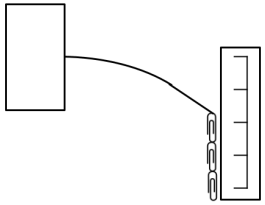
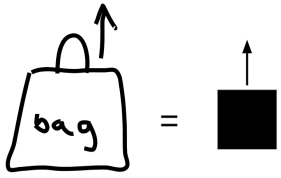
This progression map is intended to supplement your scheme or the national curriculum. You can use it to emphasise the key learning you want at each key stage.

	Feeling Forces	Talking Forces	Measuring Forces	Drawing Forces	Thinking Questions
EYFS	Make sure pupils have experienced forces - both those they produce (lifting, pushing, pulling, twisting etc.) and those they feel on their bodies (e.g. those they feel on playground apparatus, such as swings, slides, see-saws etc).	As they are experiencing the forces, draw their attention to the experiences. Ask questions like: • Are you **pushing** or **pulling** the truck? • Are you **twisting** the rubber block? • Are you **bending** the toy? • Are you **stretching** • Are you **squeezing** the peg? • What does it feel like when someone **pushes** you on the swing? • What does it feel like when someone pushes up on the see-saw? • What does it feel	Before measuring forces, learners need to have a sense that forces have a size. • Is the push/pull big or small? • Do you have to push harder when you push the trolley on the carpet? • Is the bag heavy or light? • If I add another block, will it be heavier or lighter? • Does it hurt if someone pushes you too hard? • Which rubber band is harder to stretch? • Which ball is harder to push	As a precursor to later drawings and visualisations, use gestures to 'draw with the body." Show your pupils how to mime pushes, pulls, twists etc. Get them to apply the gestures to examples - e.g. show me a big push. Show me a tiny twist. Show me an elephant pushing against a tree. Show me a very gentle push. This is the first stage towards abstract representations of forces. Later they will draw stick people pushing objects. Eventually, they will represent forces by drawing arrows.	• How can you make the bag heavier? • How can you make the ball squash more?

		like when you go round on roundabout?	under the water?		
KS1	Expand pupils' experiences of forces where possible - • stretching rubber bands and springs; • tug of war; • using simple pulleys to lift things; • see-saws are useful to feel the forces required to lift things. You can put objects on one side and use the see saw to lift it; • when you go round a corner in a car; • when you go over a bump in the road; • When you accelerate in a car; • When you slow down quickly in a car;	The key is to **feel** the forces and then **talk** about them. • If you pull on the elastic band harder, what happens to how long it gets? • If you go round a corner faster, is the push you feel bigger or smaller? • Is the force bigger or smaller when you slow down quickly. You want to encourage the standard phrase: ***The faster*** *you speed up,* ***the bigger the push*** *you feel.* ***The faster*** *you go over a bump,* ***the bigger the push*** *you feel.* ***The harder*** *you stretch an elastic band,* ***the longer it***	Extend the EYFS questions. You don't need to measure anything, but continue to compare relative size of forces.	Continue to use and encourage pupils to use gestures - this doesn't ever need to stop. If you watch a physics lecturer, they always gesture. When pupils are ready, simple stick people pushing and pulling is a useful next step towards abstraction.  The drawing quality isn't important, and it can be on scrap paper or mini-whiteboards if you prefer. The act of converting to an image is enough to make the concept more memorable.	

	• when a lift goes down, or stops going up and • pushing a ball into water to feel the buoyancy (upthrust). (note - this isn't really a curriculum of experiences, more a list of examples to add to your pupils' experiences.	***gets***. (It's worth practicing this phrase - it is super useful.)			
LKS2	All of the above. You could consider adding: • The feeling of dragging a parachute through the air (or water). • Pushing streamlined and non-streamlined objects through the water.	Introduce the term **force** and begin to supplement the words: push, pull twist, stretch, lift etc with the word 'force'- for example: • If you use a bigger **force** to push Mary on the swing, what happens? • Is the **force** you need to lift the bag more or less? • Can you bend the rubber using just a tiny **force**? The forces you will want to introduce include: • Friction between two surfaces (e..g	Pupils can make a simple force meter. I use a coffee stirrer or a plastic gardening plant label. Get a blob of blu tac or plasticine on the table and push the stirrer/lanel into it. When you apply a small force, the stirrer/label bends. If you double the force, it bends twice as much.	 Add an arrow to show the direction of the force.	Is it easier to push an object through the sand, or pull it? (it should be the same, but if a corner digs in one way and not the other, it won't be the same). If two equal forces push an object from each side, what happens? (this is like when you push both arms of a peg - the shape may change, but the object's motion doesn't change). Do all objects bend twice as much if you push twice as hard? (answer: some do, some don't).

		tyre and the road or trainers and the floor). • Air resistance (use a parachute). • Water resistance (pull a bucket through the water). • Upthrust (or buoyancy) - this is for floating things (not things with wings) - e.g. a helium balloon in the air, or a boat on the water. • Lift - this is for things with wings. For lift to work, the wings have to cut through the air at some speed.	 A simple force meter You can add a scale if your pupils are ready for it - a piece of squared paper stuck to the wall beside the force meter is enough. You don't need to do much measuring with it, but if you want to, you could measure how strong a magnet is (put a paperclip onto the top of the stirrer and see how far you can pull it). Or you could see how strong a thin thread is by tying it to the stirrer and pulling it. **Note**: you can make a demonstration one with a metre ruler. **Advanced….** You can flip the whole force meter on its side and use it to measure the weight of	 *(lifting a bag)*  *(Water pushing a ball up - upthrust)*	If the park flooded and then the water froze, would it be harder or easier to push the swing? Or spin the roundabout? (with no friction, if you pushed an object, you would move off backwards too).

			small objects.  **You can also use any scales or measuring equipment you find in the maths cupboard.**		
UKS2	A trip to a theme park is always popular - but it's still worth taking pupils to the local park and experiencing the sensation of swings, roundabouts, see-saws etc. Be sure to remember to discuss the feeling of the forces.	Continue to reinforce the names of specific forces, but emphasise that they are all **forces** and can be measured using a force meter. The unit that scientists use for forces is the newton (lower case). For a sense of what a newton feels like, it is about the weight of a large apple.	Force meters - it is time to introduce commercial force meters if you have them (sometimes called Newton meters). You can use them to measure the force needed to lift Calibrating a force meter  Use the simple force meter on its side. Mark on the scale when no paperclips	Your diagrams can become increasingly abstract. Model to pupils how you go from a concrete image to an abstract one. E.g. 	Does a pull of 1N have the same effect as a pull of 1N? (see above) When you squeeze a peg, are you pushing in with the same force on both sides? (answer - yes). If a see-saw is balanced, do the two people have to weigh the same? (answer, no - the distance from the middle also matters). How can you tell if a material bends twice as much when you apply

			are added (0), where it moves to when 1 is added, etc. Once the calibration is done, you can use the force meter horizontally or vertically (just more the scale to make sure zero shows zero). There is a lot of great "how science works" available to you here. First, the idea that you need to calibrate any measuring instrument - and that a person had to decide (including thermometers, rulers, clocks. (This free booklet by Richard Brock is great for background stories).		twice the force?