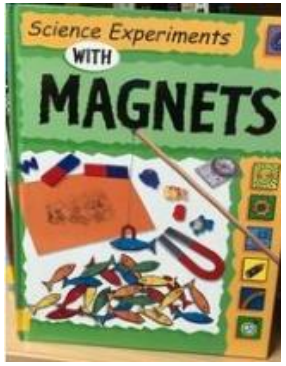
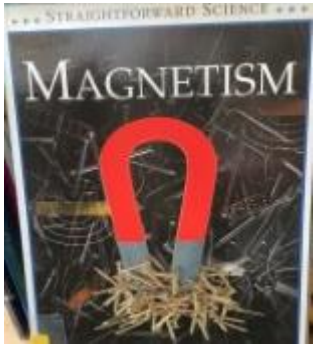
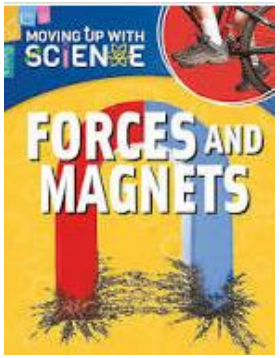
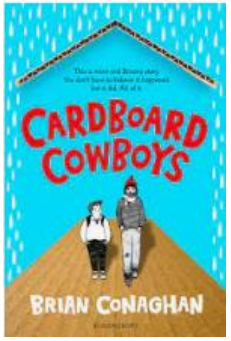
BILSTON CHURCH OF ENGLAND PRIMARY

MEDIUM TERM PLANNING

Subject	Topic/Key Question	Year Group	Term	Time Allocation
Science	Forces	5	Spring 1	16 hours
 Library	 Library	 Y5 text	 Library service	 Reading for pleasure box
End of upper Key stage 2 Outcomes	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, taking repeat readings when appropriate. Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, 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 and degree of trust in results, in oral and written			

	forms such as displays and other presentations. Identifying scientific evidence that has been used to support or refute ideas or arguments.
End of Unit Outcomes	I can explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. I can identify the effects of air resistance, water resistance and friction, that act between moving surfaces. I can recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect.
Vocabulary	air resistance water resistance friction surface force effect move accelerate decelerate stop change direction brake mechanism pulley gear spring theory of gravitation Galileo Galilei Isaac Newton, gravity.

Lesson Sequence	Time Allocation	Key Question/WALT	Teaching Activities	Resources
Lesson 1 What are forces?	2 hours	WALT: measure, using appropriate units, friction between moving surfaces as part of an investigation into how the surface area and	**Working scientifically:** Taking measurements, using a range of scientifi c equipment, with increasing accuracy and precision, including taking repeat readings when appropriate. Children identify the pictures on the Lesson Presentation (Twinkle) as pushes or pulls. Discuss their ideas. Explain how forces affect the movement of an object and discuss the different types of force as shown on the Lesson	Twinkle Forces lesson Pack – Bingo cards Lesson 1 Collins Snap Science Lesson 1

		materials affect friction WILF: I can use a Newton meter with accuracy. I can record my results in a table. I can identify the effect of friction in my investigations. I can explain my results using scientific vocabulary, including the word 'friction'.	Presentation. Can children identify forces as pushes and pulls? Identifying Forces: Children use one of the differentiated Identifying Forces Bingo Boards to play a form of bingo as described on the Lesson Presentation. Read out a Force Card for children to fill in on their bingo board. Can children identify the different forces at work in the images? Talk about Forces: Ask pairs to read the story on the Talk about Forces Activity Sheet together and to highlight or underline examples of forces in the story. In the next column, they should then briefly explain the forces that are being applied in each example. Can children identify and explain together the different forces acting on objects? Create a poster demonstrating the different kinds of forces we have discussed.	.
Lesson 2 Gravity	2 hours	WALT: explore the effect that gravity has on objects and how the first theory of gravity was developed. WILF:	**Working scientifically:** Identifying scientific evidence that has been used to support or refute ideas or arguments. Falling Down: Drop a bouncy ball and ask children to discuss their ideas about gravity using the prompts on the Lesson Presentation. Explain the force of gravity using the information on the Lesson Presentation. Can children explain the effect of gravity on unsupported objects?	Twinkle Forces Lesson 2 Newton Meters Record Table

		I can explain the effect of gravity on unsupported objects. I can explain Isaac Newton's role in developing a theory of gravity. I can accurately measure the force of gravity pulling on objects.	**Discovering Gravity:** Children discuss any existing knowledge they have of Isaac Newton and discuss briefly how Isaac Newton developed his theory of gravity.. Children use the **Newton and Gravity Fact Sheet** to answer the comprehension questions on the differentiated **Newton and Gravity Activity Sheet**. Can children explain Isaac Newton's role in developing a theory of gravity? **Weight and Mass:** Explain the difference between weight and mass, and how to measure them, using the information on the **Lesson Presentation**. **Measure the Force of Gravity:** Explain how children will measure the weight and mass of different objects using the **Lesson Presentation**. Children complete the differentiated **Measuring Gravity Activity Sheet** with their prediction, results and conclusion, and conduct the investigation in pairs. Can children measure the weight of objects? Can children explain that the weight of an object is caused by gravity pulling it down?	
Lesson 3 Why does an object fall?	2 hour	WALT: use evidence to explain how objects fall through the air. WILF: I can plan a comparative test to investigate	**Working scientifically:** Identifying scientific evidence that has been used to support or refute ideas or arguments. **This lesson build on prior understanding from previous lesson** **EXPLORE:** Select objects that are obviously different in size and weight.	Collins snap Science Lesson 2 Resources for challenges

		my ideas about how objects fall. I can identify how scientific evidence has been used in arguments. I can explain why objects fall using scientific vocabulary.	Ask: *What will happen if I let go of these objects?* Drop the objects one at a time. Ask children to discuss, in pairs, what is happening. Select some responses to write on the board. Remind children that if something moves, a force must be involved. Ask: *What force is making the object fall?* If necessary explain that the force is gravity. Write it on the board. Explain that gravity is a pulling force that acts between objects, in this case between the objects and the Earth, and that gravity is a non-contact force. Select two objects of obviously different size and weight, for example, a paper clip and a book. Ask: *What will happen if I drop these at the same time?* Select some responses to record on the board. Drop the objects several times. They will hit the ground at the same time. Encourage children to discuss this and write their comments. Were they surprised? Ask: *What will happen if I drop a fl at piece of A4 paper held horizontally at the same time as a piece of A4 paper screwed into a ball?* Drop the pieces of paper at the same time, from the same height. Ask children to discuss, in pairs, what they observe. Explain that as well as gravity pulling downwards another force acts upwards. This force acts in the opposite direction to gravity. Introduce 'air resistance'. Write it on the board. Ask why it affects the paper more than screwed up paper. **ENQUIRE:**	

			Explain to children that their challenge is to test the ideas of two scientists from long ago, and to decide who was correct. Show the Aristotle and Galileo challenge slideshow (Slideshow 1). Keep this on the screen as children carry out the challenges. Explain to children that almost 2500 years ago in Greece, Aristotle thought that heavier objects fall faster than lighter objects. Galileo, four hundred years ago in Italy, thought that all objects fall at the same speed, no matter how heavy Set up the three challenges as a carousel of activities for children to enquire in groups.	
Lesson 4 What is air resistance?	2 hour	WALT: investigate the effects of air resistance. WILF: I can explain how air resistance affects moving objects. I can plan and conduct an investigation into the effects of air resistance.	**Working scientifically:** Taking measurements, using a range of scientifi c equipment, with increasing accuracy and precision, including taking repeat readings when appropriate**.** Use the **Lesson Presentation** to explain that gravity causes objects of the same size and shape but of different mass to fall at the same rate. Discuss Galileo's experiment and how it proves this. (Children may find this hard to grasp as air resistance often causes objects with less mass to fall more slowly.) Children discuss how when a feather and a hammer fall on the Moon, they land at the same time due to no air resistance. **Air Resistance:** Use the **Lesson Presentation** to explain the effects of air resistance, and how this affects objects falling when on Earth. Children discuss the useful and unhelpful effects of air resistance using the diagrams on the **Lesson Presentation**.	Twinkle lesson 3 Material making parachutes.

			The Perfect Parachute: Explain the context of the investigation using the **Lesson Presentation**. Ensure children understand how to make their different parachutes. Children discuss the possible variables, then reveal the suggestions on the **Lesson Presentation**. They should make their own decisions about how to plan the experiment and record their choices and their prediction on the differentiated **Perfect Parachutes Activity Sheet**, then conduct their investigation. Children complete their results on the activity sheet. Can children plan and carry out their own investigation into the effects of air resistance on different parachutes?	
Lesson 5 Does the shape of an object affect its movement in water?	2 hour	WALT: measure the effects of water resistance. WILF: I can take accurate readings using a stopwatch. I can use my results to identify which object has the least water resistance. I can identify the forces that start the	**Working scientifically:** Taking measurements, using a range of scientifi c equipment, with increasing accuracy and precision, taking repeat readings when appropriate. Do you children know anything about Water Resistance? Combined the presentations from Collins and twinkle to explore how the shape of an object can improve its water resistance. **EXPLORE:** Ask children if it is easier to run in air or in water. Ask them to discuss their ideas in pairs, including reasons for their answers. Select some responses to share with the class. Show children the Moving in water video (Video 1), which shows people on the beach. Ask children to look particularly at the boy who runs into the sea and the boy nearer the	Collins snap science Lesson 5 Twinkle Forces lesson 4 Modelling clay Materials to make a boat. Water tray or piping .

		object moving and stop the movement.	camera who is walking out of the sea. Prompt them to look at how the two boys move in the water. Explain to children that it is a type of friction called water resistance that is making the children walk in that way in water. Water resistance is similar to air resistance that slows objects down as they move through air. **Streamlined Shapes:** Explain streamlining using the examples on the **Lesson Presentation**. Children work in groups to conduct the mini-investigation into streamlined shapes as described on the **Lesson Presentation**. Explain why the shapes fell at different speeds as a result of some shapes being more streamlined than others. Can children identify streamlined shapes? To ensure children understand about the shapes the challenge from Collins could be carried out first. **Boat Building:** Children complete the boat race challenge as described on the **Lesson Presentation**. Provide children with the junk modelling equipment so they can make their boats, then time how long it takes each boat to cross the water tray. Children then work on their own to complete the differentiated **Boat Race Activity Sheet** by drawing and labelling their design and making a prediction for how well they think their boat will move through the water. Can children discuss how they might minimise the effects of water resistance in their design?	
Lesson 6	2 hour	WALT: identify and explain the effect of upthrust on objects in water.	**Working scientifically:** Reporting and presenting fi ndings from enquiries, including conclusions, causal relationships	Collins snap science lesson 6

Do all heavy things sink?		WILF: I can explain why objects record a different mass in water and in air. I can record results systematically and take repeat readings. I can use the term 'upthrust' to explain how an object floats	and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations. **EXPLORE:** Start the lesson by showing the class the Floating or sinking slideshow (Slideshow 1). Ask: *What forces do you think are acting on each object in the pictures?* Remind children of previous learning about balanced and unbalanced forces. Ask: *If the object isn't moving are the forces balanced or unbalanced? What forces are acting on these objects?* Ask a child to make two identical weight balls of clay – about 100 g. Ask: *What will happen when they are dropped into water?* Ask if anyone thinks they could reshape the clay to make it float. If necessary, demonstrate how a hollow bowl shape will float. Ask: *Why does the hollow ball shape float, but not the ball?* Explain that the challenge is to find out why some objects float but others sink. **ENQUIRE:** Show children a 2.5 N Newton meter. Hang a ball of modelling clay from the Newton meter with an elastic band. Ask a child to read out its weight in Newtons. Lower the modelling clay ball into a tumbler half full of water until	

			completely submerged. Ask the child to read out the weight in Newtons. Write the two weights on the board. Let a different child repeat the measurements with a different sized ball of modelling clay. Ask children what they noticed about the modelling clay's weight each time. Then gently push upwards on the ball of modelling clay still attached to the Newton meter. Ask a child to watch the scale on the Newton meter and to say when it reaches the same reading as in the water. Invite a few children to take turns at pushing a small, inflated balloon into water in a tank. Ask: *What can you feel?* Children should feel the push of the water. Explain that this force is called upthrust. The challenges are differentiated by type and precision of recording and complexity of context. Evidence from all three challenges will be combined to explain why things float. Children work in groups of three. The challenges are presented on the Challenge slides to be displayed on the board, or printed out and placed in the centre of the table.	
Lesson 7 How can we use	2 hour	WALT: demonstrate how levers work and how they reduce the force required to move objects.	**Working scientifically:** Taking measurements, using a range of scientific equipment with increasing accuracy and precision, including taking repeat readings when appropriate.	Collins snap science Lesson 8 Twinkle lesson 6 resources

levers to help us?		WILF: I can use levers to move objects. I can explain that when something is moved using a lever, less force is needed. I can label a diagram using scientific vocabulary to explain how a lever works.	**EXPLORE:** Ask children what they think a mechanism is. Explain that it is a device that makes work using forces easier. Inform children they are going to use levers – a type of mechanism. Show everyday levers: scissors, pliers and claw hammer. Explain that these levers need a moving force to make them work. Give children empty tins with inset lids. Ask them to work in pairs to open the tins. Ask if they know how to open them easily. Give out the teaspoons and ask children to use them to open the tins. Ask: *How did you use the spoon to open the tin?* Emphasise that they used a force to push down on the spoon, which pivots on the edge of the tin. There is an upward force on the other end of the spoon that lifts the lid. (Put the end of the teaspoon handle, not the bowl of the spoon, under the lip of the lid.) Remind children of the arrows they used previously to show directions of forces. Ask: *In which directions are forces working? Where is the pivot point? What playground item works like this?* To explain the lever mechanism ask a child to hold the end of the handle of a long-handled wooden spoon. Explain that they are representing the lid of the tin. Hold the handle between your finger and thumb near the same end of the spoon. This is the fulcrum, where the lever pivots. Show what happens when a downward force is applied to the other end of the spoon as it pivots in between your finger	Resources to make levers

			and thumb. Ask the child what they feel happening where they are holding the handle. Establish that the spoon is a lever and that this was the mechanism that helped to open the tin. Explain that levers have three parts: the fulcrum, where the lever pivots; the weight arm (the part from the fulcrum to the weight to lift); and the force arm (the part from the fulcrum to where you push or pull). Ask: *Can you name these parts in the lever you used to open the tin?* Ask children each to draw on mini whiteboards a diagram of the tin being opened with a spoon and label it with this vocabulary. **ENQUIRE:** Explain to children that they are going to investigate how to use levers to change the force needed to move things. The challenges are differentiated by how children describe or measure the effects of levers. Children work in groups of three. The challenges are presented on the Challenge slides to be displayed on the board, or printed out and placed in the centre of the table.	
Lesson 8 How do levers help us?	2 hour	WALT: demonstrate how levers work and how they reduce the force required to move objects.	**Working scientifically:** Taking measurements, using a range of scientific equipment with increasing accuracy and precision, including taking repeat readings when appropriate.	Collins snap science lesson 8

		WILF: I can use levers to move objects. I can explain that when something is moved using a lever, less force is needed. I can label a diagram using scientific vocabulary to explain how a lever works.	**Continuing from previous lesson** **Talk about It:** Display the images of different mechanisms on the **Lesson Presentation**. In pairs, children discuss anything that they might already know about these mechanisms and how they might be related to the topic of forces. **What Are Mechanisms?** Using the **Lesson Presentation**, briefly explain what a mechanism is. Then organise children into groups of three. Each member of the group should visit a different table to find out about a particular type of mechanism. On the table, they should find the pre-cut jigsaw pieces from the **Mechanism Facts Activity Sheet**. Children read the facts and piece the jigsaw back together, making notes on their **Mechanisms Jigsaw Activity Sheet**. They then go back to their original group of three and share their findings to complete the other sections of their activity sheet with the new information from their group members. Can children explain how different mechanisms work? **Identifying Mechanisms:** Children identify the type of mechanisms used in the objects shown on the **Lesson Presentation**. Share the answers with the children. Cracking Contraptions: Discuss the different machines shown on the Lesson Presentation. Point out that the machines use many different mechanisms to achieve a simple purpose. If you wish, children could watch a video clip of a machine working at this point in the lesson. **Marvellous Machines:** Children design their own crazy machine that uses many different mechanisms to achieve a	

			simple aim. Children can choose a card from the pre-cut **Machine Aim Cards Activity Sheet** to select an aim for their machine or they can think of their own aim. Children draw and explain their designs on the differentiated **Marvellous Machines Activity Sheet**. Can children include some of the mechanisms they have investigated in their own machine designed for a given purpose?	