SS John Fisher & Thomas More Catholic Primary School

A Voluntary Academy

Year Group: Year 5	Term: Autumn 2	Topic: Forces

National Curriculum Links

Pupils in Key Stage Two should be taught to:

- 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.

Working scientifically

- plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- use test results to make predictions to set up further comparative and fair tests
- report and present findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations
- identify scientific evidence that has been used to support or refute ideas or arguments

Prior Learning	Future Learning
• 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)	• 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)

Common Misconceptions

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.

Sustainable Development Goals & Catholic Social Teaching

These Sustainable Development Global Goals would be perfect to fit with this unit of learning:

These Catholic Social Teaching strands would be perfect to fit with this unit of learning:

Applied Write Opportunities	Enrichment Opportunities

Assessment Opportunities

- **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**
- **Can demonstrate clearly the effects of using levers, pulleys and gears**

Key Vocabulary
Tier Two: ***forces, weight, gravity, push, pull*** **Tier Three:** **mass, gravitational pull, air/water resistance, buoyancy, streamlined, aerodynamic**

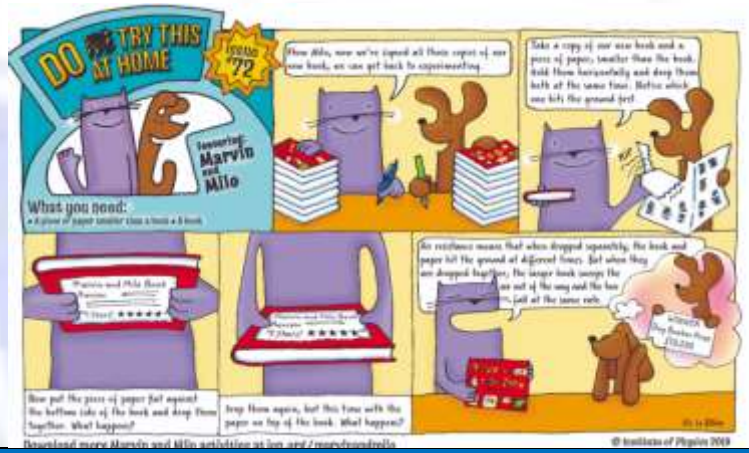
Knowledge and Skills Objectives	Activity	Differentiation
Lesson One I can identify forces and how they affect objects around us. Working Scientifically	Starter: Mind map all that children can recall about forces on flipchart paper using TTYP (last addressed in Year 3). Do any of their ideas link together? Do other children agree with ideas raised? This can be added to throughout the unit as more learning is achieved. Whole class activity (1): Generate a discussion about forces. TTYP what is a force? TTYP can you think of any examples of where forces are acting? Gather feedback. 1. Carefully select two volunteers to each hold the end of a skipping rope. 2. Ask the rest of the class to describe the shape of the rope as the volunteers just hold the rope ends without any pulling force. 3. Can the children explain how to make the rope straight? Identify that a pulling force is needed. Do both volunteers need to pull? What happens if one child pulls harder than the other but neither child lets go? Explain that the pull force causes tension in the rope. The force of tension travels right through the rope. If both children and the rope are static, then the forces are balanced. If the rope moves left or right, then the forces are unbalanced and the rope moves in the direction of the greater force.	Task 1 SEN: Rope image printed and children to draw the arrows onto the image. Write a simple sentence that explains whether the forces are balanced or unbalanced. LA: Same as SEN but with a simple explanation as to why the forces are balanced or unbalanced. MA/HA: Draw the rope demonstration into their books and draw on the arrows. They need to explain what happens if the forces are unbalanced. Task 2 SEN/LA: Draw each step of the playdough activity (boxes labelled to support their drawings). Challenge: Can they add keywords to any of the boxes to push their learning further?

	Children's Task (1): Record their ideas and understanding from this demonstration into their books. Whole class activity (2): (Practical exploration of forces using playdough/clay/plasticine) 1. Give each table a large, single piece of clay and set it on the table. (TTYP) Are the forces balanced or unbalanced? How do you know? 2. Ask the children to share the clay between them. Then ask what they did to share the clay. Agree that they may have used pulling and twisting forces to rip the clay. 3. Children then can create a shape of their own choice using their piece of clay.. 4. Discuss the types of tension or twisting forces they used on the clay: twisting, pushing, pulling etc. How did each force affect the modelling clay? **Use KO 'Forces can make an object…' diagram. Did any of these points** happen when you made your shape? **Children's Task (2):** Using the box template sheet. Children to record what they did with their clay.	MA: Draw each step of the playdough activity in their boxes. They must write a brief sentence about what is happening in each stage using key vocabulary introduced today. HA: To draw and explain each stage of the playdough activity. Can they draw arrows onto the playdough to show the forces acting on it.
Knowledge and Skills Objectives	**Activity**	**Differentiation**
Lesson Two I can explain that gravity is a force that pulls objects down. Working Scientifically	Starter: Watch this video: https://www.youtube.com/watch?v=E9oKEJ1pXPw Can FF if needed and where appropriate. (TTYP) Why is it that we know exactly what will happen as soon as the man steps off his platform? Why do things fall? Establish that there is a force called weight. Weight is caused by a force field called gravity pulling towards the centre of the Earth. (TTYP) What forces were acting on the astronaut? (TTYP) Was there more than one force happening? Whole class activity: Introduce Isaac Newton and his discovery of gravity: he saw an apple falling out of the tree, which intrigued him immensely.	Task 1 SEN: A pre-prepared results table which just expects them to record the gravitational force acting on each object. A brief summary sentence that identifies the objects that has the most and least gravitational force. LA: A pre-prepared results table to compare mass and gravitational force.

	Explain that he spent a lot of time thinking about gravity and how it pulls objects towards the centre of the Earth. It is a force that we measure in newtons (N) as a tribute to Isaac Newton. Explain that mass of an object and the force of gravity between Earth and objects are different. Tell children that we are going to investigate this. (TTYP) What can we use to measure the mass of the object? (small weighing scales) / force of gravity? (force metres) We will be recording our results onto a table. Teacher to model activity including recording findings. **Children's Task:** Working in small groups, children will explore the relationship between an objects mass and its gravitational force. Plenary: (Explorify activity – Odd one out) **'Defying gravity'.** Three images: bubbles, a plane and dandelion seeds in transit. (TTYP) Which image is the odd one out? Can you explain why?	A brief summary sentence about the results that surprises them the most. MA/HA: A pre-prepared results table to compare mass and gravitational force. A short explanation that describes their findings from this activity. Challenge: What would happen if there was no gravity?
Knowledge and Skills Objectives	Activity	Differentiation
Lesson Three I can identify and describe friction. Working Scientifically	Starter: (Explorify activity – **Zoom in/ Zoom out) 'Black bobbles'.** Several images to flick through – a close up, then each time an image zoomed out of the object. (TTYP) What do you think it is? Why? Can you describe the colours, shapes and textures? What do they think the image is now? Have they changed their minds?	Task: All children working in small groups will engage in the investigation. There will be one person recording for each group and the other children will have a practical role. Results to be photocopied for the group so they all have a set in their books. They will write their own conclusions in their books. SEN: Copy and complete the model conclusion text into their books.

	Background science Friction is a force that occurs when surfaces are in contact and moving against each other. It's this friction between tyres and the road that stops you slipping around when you're on a bike, in a car or on a bus. The repeated friction between tyre and road surface causes the tread (the bit that makes contact with the ground) on the tyre to wear down, if you look closely you'll see evidence of this in the tyre image as you zoom out. <u>Whole class activity:</u> (TTYP) How is friction created? What do you do with cold hands? Why? What happens? 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. Investigation context: show image of person at work, who has slipped on a school kitchen floor. Ask: what has caused this person to slip? Take suggestions. Tell the children that the floor was slippery and the person fell as a result. Ask, what can we investigate? Investigation: Which is the most effective floor material to prevent people from slipping in the kitchen? <u>Task (1):</u> Children to explore the properties of floor materials (laminate, stone, concrete, marble, carpet, wood) first at their tables. Observe, feel and discuss. Children to feedback their predictions – Write down their predictions that answer: Which material will prevent people from slipping the best? Why do you predict this? <u>Task (2):</u> Plan fair test together (whole class) asking children to suggest what variables need to change, measure/observe and keep the same. <u>Task (3):</u> Children to work in small groups to investigate our question recording results as they go. Method: Use a force meter to pull a shoe with a weight in over different surfaces to measure the force. Observe performance of the shoe being pulled. Record results. Discuss results – were there any	<u>LA:</u> Given question prompts to write their conclusion. <u>MA/HA:</u> Given a keyword bank to write their conclusion.

	unusual results? How did the shoe move when dragged over the different materials? Similar or different? Conclude results together. Then, children to complete their own conclusion statements using prompt sheets.	
Knowledge and Skills Objectives	Activity	Differentiation
Lesson Four I can identify and explain what air resistance does. Working Scientifically	Starter: Show two objects 1. a piece of paper folded 4 times. 2. flat paper. Discuss which will fall the fastest and why. **Introduce children to the term 'air resistance'. Children to use their KOs to** read the definition of this force. Discuss the effects of air resistance on these different objects. Whole class activity: Discuss different examples of air resistance acting in real life: riding a bicycle, a leaf falling from a tree and on an aeroplane. Practical exploration using a CLEAPSS activity (with a twist): *Making and successfully throwing a boomerang.* *http://primary.cleapss.org.uk/resource-file/p085-making-and-successfully-throwing-a-boomerang.pdf* Explain that children will work in pairs and create two different boomerangs (templates provided). One solely made from A4 paper and the other from A3. Children to explore the effect of air resistance on the different size of boomerang. They should throw the boomerang from the same height and at the same force (teacher to encourage this: one person does the throwing and the other makes the observations.) Explore their throwing and height levels before recording results. Children to use their stop watches to time the length of time the A4 boomerang takes to fall to the floor (3 times) and then the same with the A3 boomerang.	Task: All children to work in pairs gathering results and recording them onto a table. SEN/LA: A group conclusion to be written into books. MA/HA: Independent conclusions to be written into books.

	Children's Task: To work in pairs exploring the effect of air resistance. Record the times onto their sheets. Plenary: IOP Marvin and Milo postcard activity to try: **'Book Launch'** 	
Knowledge and Skills Objectives	Activity	Differentiation
Lesson Five I can describe and explain how water resistance works. Add w/s here	Starter: (Explorify activity – **Odd one out) 'Sleek designs.' Three images: a** penguin swimming, a diver and a boat. (TTYP) Which one is the odd one out? Start to generate a discussion about the similarities and differences of each of these things in the water. What about the shapes they are? Whole class activity (1): Recap air resistance (TTYP). Explain that as well as having air resistance, there is a force called water resistance. (TTYP) What could this be about? Can you use what you know about air resistance to help you? Children then to use KOs to check their definitions – were they correct? Explain that water resistance is also the force responsible for making it difficult for us to move through the water. It acts between a moving object and the water molecules around it, slowing the object down. Water resistance is a type of friction. Boats are streamlined in design to reduce	Task (1) SEN/LA: Children to be given a picture of a boat. They should label the forces acting on the boat out at sea. Compose a group sentence about water resistance and write this underneath. MA: Given a picture of a boat. They should label the forces acting on the boat. Write a short description about what water resistance is. HA: Given a picture of a boat. They should label the forces acting on the boat.

	water resistance, allowing them to move through the water faster. (TTYP) What does streamlined mean? Refer back to first three images. How are they streamlined? (TTYP) Look at the bodies of some aquatic animals to reinforce understanding of **new terminology** 'streamlined.' Look at water resistance in action – explore the forces acting on a boat. Can children work this out with their partner. **Children's Task (1):** Explain what water resistance is in their books. Whole class activity (2): What type of shape creates the least amount of resistance in water? (TTYP) **Children's Task (2):** Explore this further in tables. Children will be provided with a container of water and some plasticine. Children should create four different shapes using the plasticine. Explore which shapes fall to the bottom of the container the quickest compare each of their shapes. Why does this happen? Pic collage for books and quotes of what children are learning or have noticed in their exploration. Plenary: Share experiences of the task and which shapes were quicker/ slower to fall. Why do you think that might be?	Explain how the boat is staying afloat with the forces acting on it including water resistance. Extension: Can you draw and label another example of water resistance in action?
Knowledge and Skills Objectives	Activity	Differentiation
Lesson Six I can describe different mechanisms. Working Scientifically	Starter: Recap! Give children some time to create a mind map (A5 paper) which details all of their learning during our '**Forces**' topic so far. Can be stuck into books for assessment purposes.	Task: SEN: Sort mechanisms into the correct boxes.

	Whole class activity: (TTYP) What are mechanisms? A mechanism is a device that changes an input force or motion into a different output force or motion. Some mechanisms make work easier to do by allowing a smaller force to have a greater effect. Introduce the three types of mechanisms: pulleys, levers and gears. What do you know about these? Children to use KO to look at the definitions. Activity (1): Sorting task on tables. Can children sort the series of objects into the category of the mechanism it has e.g. a seesaw, a toilet, a bicycle etc. Use the above activity as a stimulus to consolidate understanding of each mechanism: Pulleys – are used to help you use a small force to lift a large load. Gears – Gears are wheels with teeth or indentations, which lock and turn one another. Gears can be used to change the speed, force or direction of motion. Levers – A lever always rests on a pivot. A lever has the point where you push or pull, the point where it pivots and the point where the work is done. Show lots of examples for each mechanism. **Children's** Task: To explain what each mechanism does using illustrations to support answers. Plenary: Can you add **today's** learning to your mind map?	LA: Fill in the gap task to complete a definition for each mechanism introduced today. MA: Create their own definition for each mechanism using the image provided as a support. HA: Create their own definitions and illustrations for each mechanism. Challenge: Design your own machine that incorporates at least one of the mechanisms we looked at today. Explain what it is used for and how it works.