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| **What have the taught us Autumn 2 and Spring 1 Term Science Year 5**    – UKS2 Title of area of learning: **Forces** | |
| **Prior Knowledge** | **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) |
| Planned outcome:  • 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.  **Key Learning**  A force causes an object to start moving, stop moving, speed up, slow down or change direction. Gravity is a force that acts at a distance. Everything is pulled to the Earth by gravity. This causes unsupported objects to fall. Air resistance, water resistance and friction are contact forces that act between moving surfaces. The object may be moving through the air or water, or the air and water may be moving over a stationary object. A mechanism is a device that allows a small force to be increased to a larger force. The pay back is that it requires a greater movement. The small force moves a long distance and the resulting large force moves a small distance, e.g. a crowbar or bottle top remover. Pulleys, levers and gears are all mechanisms, also known as simple machines.  **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.  **Possible Evidence**  • Can demonstrate the effect of gravity acting on an unsupported object  • Can give examples of friction, water resistance and air resistance  • Can give examples of when it is beneficial to have high or low friction, water resistance and air resistance  • Can demonstrate how pulleys, levers and gears work | |
| Learning Journey  Step 1- What is a force.  To identify forces acting on objects.  Step 2 Levers  Image result for leverA **lever** is one of the most useful simple machine used in lots of places ie. Seesaw. It has 4 basic parts:  **Beam:** The lever, a wooden plank or metal bar resting on the fulcrum.  **Fulcrum:** The pivot or turning point  **Force:** the effort needed to move the beam and the load  **Load:** the item or object being moved or lifted on the plank  If one end of the lever is pushed down, the force will lift the other end. If the other end has a load on top of it, it will be easier to move the load. The lever makes lifting the load easier. Types of levers depend upon the position of the fulcrum eg.    Step 3 Pulleys  **Pulleys** are made by looping a rope over one or more grooved wheels. They are often used to lift heavy objects: pulling down on one end of the rope creates an upward pull at the other end. Looping the rope over more wheels increases the upward force    Step 4 Gears  **Gears** are wheels with teeth that slot together. When one gear is turned the other turns as well. If the gears are different sizes, they can be used to increase the power of a turning force. The smaller one turns more quickly but with less force while the bigger one turns more slowly with more force. Cars and bicycles use gears to achieve amazing speeds that we cold never achieve without help.    Step 1b – Effects of gravity  To explore the effect gravity has on objects and how gravity was discovered.  **Gravity** is sometimes known as an ‘invisible force of nature’. Gravity is what keeps us on the ground and the planets in their orbits. Weight is a downward force due to the pull of gravity and is measured in **Newtons.** Your weight would be less on the moon because there is less gravitational pull on the moon.    **Friction** is the force that exists between the surfaces of two objects that are in contact with each other, when at least one of them is moving. If a block is pushed across a table, the initial force, the push, starts the block moving. It stops because the force of friction works against this movement. If the surface is rough it has greater frictional force. Lubricants can be used to counteract the effect of friction between two moving surfaces eg. if you oil your bike chain regularly the friction between the chain and the axel will be reduced.    Step 2b    **Air resistance** is the force that opposes the movement of objects in the air. When an object moves through the air, the air pushes against them and slows them down. A ball of paper that is dropped will fall faster than a sheet of paper that is dropped because there is less air resistance being exerted on it due to its smaller surface area. The gravitational pull on both pieces of paper is the same.    If 2 balls of the same size but of different weights were dropped they would land at the same time because the air resistance on both is the same. The gravitational pull on the heavier ball would be greater but this doesn’t mean that it falls faster.    Step 3b  **Water resistance** occurs when an object moves through the water or across the top of the water, pushing against it or slowing it down. Water resistance is independent of the speed of the object. The more molecules that are in a liquid the greater the effect of the resistance. The factor that affects the movement the most is the surface area of the object in the water.    The effects of both water and air resistance can be overcome by streamlining to reduce the surface area in contact with the air or water.    Water resistance and air resistance are both forms of friction and are used to explain how moving objects slow down.    A ball of clay will sink in a bowl of water, however if the ball was made into a small boat it would float. The gravitational pull on both is the same but the **upthrust** from the water is greater on the boat with a larger surface area; this is how large metal ships can float. If upthrust is equal to or greater than gravity an object will balance.    A stationary object doesn’t move because the forces on it are balanced. | Tiered Vocabulary  **3**  **2**  **1**  **How can levers, pulleys and gears help us**    **Gravity:** a natural force that causes things to fall towards the Earth  **Mass:** a measure of the amount of matter in an object (measured in grams and kilograms). This stays the same whether you are on Earth or in space (mass shouldn’t be confused with weight)  **Weight:** the force of gravity on an object. This changes whether you are in Earth or space  **Friction:** a force between 2 surfaces that are sliding, or trying to slide, across each other eg. when you push a book along the floor, friction makes this difficult  **Sir Issac Newton:** A famous scientist who developed the theory of gravity and the 3 laws of motion.  **Lever:** a basic form of a machine that helps us lift loads with less effort ie. A seesaw; a long, sturdy body that rests on a support **(Fulcrum)**  **Pulley:** a simple machine that uses grooved wheels and a rope to raise, lower or move a load  **Gear:** wheels with teeth that slot together. When one gear is turned the other one turns as well  **Force:** A push or pull on an object. A force can cause an object to accelerate, slow down, remain in place, or change shape  Where would we be without water?    What are the effects of air resistance, water resistance and friction?    **Gravity:** a natural force that causes things to fall towards the Earth  **Mass:** a measure of the amount of matter in an object (measured in grams and kilograms). This stays the same whether you are on Earth or in space (mass shouldn’t be confused with weight)  **Weight:** the force of gravity on an object. This changes whether you are in Earth or space  **Surface area:** a measure of how much exposed area a solid object has  **Air resistance:** is a type of friction between air and another materials eg. when and aeroplane flies through the air, air particles hit the aeroplane making it more difficult for it to move through the air.  **Water resistance**: a type of friction between water and another material  **Upthrust:** an upward thrust or push  **Friction:** a force between 2 surfaces that are sliding, or trying to slide, across each other eg. when you push a book along the floor, friction makes this difficult  **Force:** A push or pull on an object. A force can cause an object to accelerate, slow down, remain in place, or change shape |
| Scaffolds/Enquiry Activities | Oracy Activities |
| • Investigate the effect of friction in a range of contexts e.g. trainers, bathmats, mats for a helter-skelter.  • Investigate the effects of water resistance in a range of contexts e.g. dropping shapes through water and pulling shapes, such as boats, along the surface of water.  • Investigate the effects of air resistance in a range of contexts e.g. parachutes, spinners, sails on boats.  • Explore how levers, pulleys and gears work.  • Make a product that involves a lever, pulley or gear.  • Create a timer that uses gravity to move a ball. • Research how the work of scientists such as Galileo Galilei and Isaac Newton helped to develop the theory of gravitation. | •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  • Demonstrate clearly the effects of using levers, pulleys and gears |