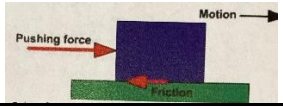
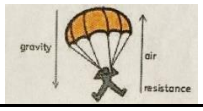
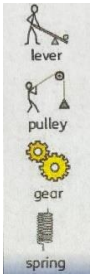
Holly Park - Science Topic: Forces

Enquiry: How and why do objects move? | **Year: 5** | **Strand: Physics**

Prior Knowledge

- 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)

What will I know by the end of the unit? Substantive Knowledge

What are forces?	Forces are pushes and pulls. These forces change the motion of an object. They will make it start to move or speed up, slow it down or even make it stop. For example, when a cyclist pushes down on the pedals of a bike, it begins to move. The harder the cyclist pedals, the faster the bike moves. When the cyclist pulls the brakes, the bike slows down and eventually stops Other forces that create resistance of motion include water resistance and air resistance 
What is gravity and air resistance?	Gravity is the force that pulls objects to the centre of the Earth. air resistance pushes up on the parachute, opposing the force of gravity . This makes the parachute land more slowly 
What is water resistance?	Water resistance is the friction that is created between water and an object that is moving through it. Some objects can move through water with less resistance if they are streamlined. 
What are examples of mechanisms? 	Levers allow us to do heavy work with less effort . For example, trying to pick up a large heavy box is difficult, however if a lever is used it becomes much easier to move it. Pulleys also allow us to do heavy work - objects are attached to ropes and pulley wheels, and so instead of lifting heavy object upwards, we can pull on the pulley rope downwards. Gears are toothed wheels. Their 'teeth' can fit into each other so that when the first wheel turns, so does the next one. This allows forces to move across a surface. Springs can be stretched by pulling them or squashed by pushing them. The greater the force pulling or pushing the spring, the greater the force the spring uses to move back to its normal shape.

Vocabulary

attract	If one object attracts another object, it causes the second object to move towards it
gear	a part of a machine that causes another part to move because of teeth which connect the two moving parts
lever	a basic tool used to lift or pry things open
opposite	Opposite is used to describe things of the same kind which are completely different in a particular way. For example, north and south are opposite directions
force	the pulling or pushing effect that something has on something else
motion	the activity of changing position or moving from one place to another
pulley	a simple machine that makes lifting something easier. A pulley has a wheel or set of wheels with grooves that a rope or chain can be pulled over
spring	a spiral of wire which returns to its original shape after it is pressed or pulled
friction	the resistance of motion when there is contact between two surfaces
surface	the flat top part of something or the outside of it
resistance	a force which slows down a moving object or vehicle
streamlined	A streamlined vehicle, animal, or object has a shape that allows it to move quickly or efficiently through air or water
gravity	the force which causes things to drop to the ground

Learning Objectives

- 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

Possible Activities

- Investigate the amount of friction created by different surfaces. Use measures (such as length and time) to show how far or fast and object travels.
- Draw diagrams to show how objects move down ramps, through the air and through water, using arrows to show the direction of the forces.
- Explore the effects of friction on motion and find out how it slows or stops moving objects, for example, by observing the effects of a brake on a bicycle wheel
- Provide examples of when friction is useful.
- Investigate how surface area affects air resistance and explain the relationship between them.
- Make parachutes to investigate how air resistance works. Ensure that only one variable is changed while other variables stay the same. Variables may include the objects attached to the parachute, shape of parachute, size of parachute, length of string attached to the object, height of drop, material of parachute. Explain why this is necessary in an experiment.
- Explore resistance in water by making and testing boats of different shapes
- Design and make products that use levers, pulleys, gears and/or springs and explore their effects
- 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.

Possible Evidence & assessment opportunity

- 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
- 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
- How and why do objects move?

Possible 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.

Future Learning

- 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)

Questions

What actually is a force?
How can a force act on an object?
How can we see forces?
How can we measure forces?
How does the saltiness (salinity) of water affect the water resistance?
How does the length of a piece of a paper helicopter's wings affect the time it takes to fall?
How does the changing the shape of a piece of plasticine affect water resistance?
How does adding holes to a parachute affect the time it takes to fall?
How does the amount/depth of tread affect the friction between a shoe and a surface?
How can we use levers to lit more?
What is the most effective way to move an object?
How do see-saws work?
Can you create a pulley system to life a given load?

Possible Texts
The Aerodynamics of Biscuits (Clare Helen Welsh)
Leonardo's Dream (Hans de Beer)

Scientists

Isaac Newton (Gravitation)

Working Scientifically (Disciplinary Knowledge)
Set up an investigation when it is appropriate e.g. finding out which materials dissolve or not. Plan different types of scientific enquires to answer given questions. 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 Report and present 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 Group and classify things and recognise patterns using appropriate ways of presenting Find things out using a wide range of secondary sources of information Use results to draw conclusions. Is evaluative when explaining findings from scientific enquiries and is clear about what has happened in recent enquiries and can relate this to other enquiries where appropriate Identify scientific evidence that has been used to support or refute ideas or arguments

LINKS TO THE WORLD OF WORK

Personal Development

The Yes Program – Science – train Driver (friction)

The Yes Program – Science – engineer (forces)

End Points and Assessment of Core Learning

Working Scientifically:
I can plan different types of scientific enquiry.
I can control variables in an enquiry.
I can measure accurate and precisely using a range of equipment.
I can record data and results using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
I can use the outcome of test results to make predictions and set up a further comparative fair test.
I can report findings from enquiries in a range of ways.
I can explain a conclusion from an enquiry.
I can explain causal relationships in an enquiry.
I can relate the outcome from an enquiry to scientific knowledge in order to state whether evidence supports or refutes an argument or theory.

Forces:
I can explain what gravity is and its impact on our lives.
I can identify and explain the effect of air resistance.
I can identify and explain the effect of water resistance.
I can identify and explain the effect of friction.
I can explain how levers, pulleys and gears allow a smaller force to have a greater effect.

Question 1: The pulling or pushing effect that something has on something else can be best described as a….	Start of unit:	End of unit:

Question 2: Which force pulls objects towards the ground?	Start of unit:	End of unit:
resistance		
magnetism		
gravity		
friction		

Question 3: A force which slows down a moving object is...	Start of unit:	End of unit:
resistance		
magnetism		
gravity		

Question 4: Label this diagram to show which forces are in action.	Start of unit:	End of unit: