The Canons CE Primary School

Y5 Science – Forces

Targets to be covered:

- 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.

Learning Ladders:

I can recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

I can identify the effects of air resistance, water resistance and friction that act between moving surfaces.

I can explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.

Working Scientifically

I can plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
I can take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings where appropriate.
I can record data and results of increasing complexity using **scientific diagrams and labels**, classification keys, **tables**, scatter graphs, bar and **line graphs**.
I can report and present findings from enquiries, including conclusions, casual relationships and explanations of result, in oral and written forms such as displays and other presentations.
I can identify scientific evidence that has been used to support or refute ideas or arguments.

Week	Order of Study – Main plots and Subplots
1	**LI- I can explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.** (hide LI to begin with) Show children concept cartoon. Chn stick in books and write down which ideas they agree with and why? Feed back to the class. Can chn explain their reasons? What is gravity? Share gravity ppt about Isaac Newton, mass and weight and 'zero' gravity. Chn to make notes in notebooks and then answer the question: 'What is gravity?' in their books. Introduce chn to diagrams representing forces with arrows. The arrow travels in the direction the force is working. Stick in or draw a picture of an object and draw an arrow to show how gravity is acting on it. Remember, gravity works on everything even if we can't see it e.g. a cup of tea- gravity is working on the cup and the tea. Address misconception (a non-moving object has no forces acting on it). Challenge- introduce the idea that if the forces are balanced (like a seesaw), then the object doesn't move. Peer assessment. **Resources needed:** concept cartoon, gravity ppt, object pictures **Key terminology**- force, gravity, Earth, upthrust, balanced, mass, weight, Newtons, matter, particles, microgravity, weightlessness
2	**LI- I can identify the effects of friction that act between moving surfaces.** Self assessment. **Resources needed:** toy car, ramp, tape measure/ruler, bubble wrap, carpet, sandpaper **Key terminology**- force, gravity, friction, push, particles, rough, smooth
3	**LI- I can plan a fair test to answer questions about the effect of air resistance on a moving surface.** **Fair testing enquiry- How does the surface area of a parachute affect the time it takes to fall to the ground?** Watch video and demonstrate A4 paper and scrunched up A4 paper ball being dropped from the same height. What do chn think will happen? Which will fall the fastest? Why? What happened? Discuss why that happens and why some objects fall faster or slower (Mass, size, weight, the effect of gravity). Address misconception (the heavier the object the faster it falls, because it has more gravity acting on it). Introduce idea of air resistance and air particles causing friction on an object. Link to gravity (unbalanced forces). How do some objects reduce the effect of air resistance e.g. cars. Their shape makes them streamlined. Discuss what this means. Can chn think of other examples? Introduce the Parachute investigation by talking to the pupils about how we could slow an object falling to the ground. Discuss parachutes. Are they streamlined? Why? What effect do they think this will have?

	Show pupils the resources we are to use – Plastic bag, String, Sellotape, Multi-link cube. Discuss and devise a sensible experiment e.g. **How does the surface area of a parachute affect the time it takes to fall to the ground?** Start the experiment write-up to reflect different sized parachutes being dropped and timed to reach the floor. Write the Aim, Prediction, Fair Test and Equipment sections. **Resources needed**: https://www.youtube.com/watch?v=dxcx35x5L9Y **Key terminology –** gravity, air resistance, friction, streamlined, pull, parachutes, fair test, variable, investigation, particles, surface area.
4 Cont.	**LI- I can plan a fair test to answer questions about the effect of air resistance on a moving surface.** **Fair testing enquiry- How does the surface area of a parachute affect the time it takes to fall to the ground?** Discuss health and safety and logistics of making parachutes. Demonstrate how to make it properly and accurately (fair test). Give each child a separate size of parachute, ranging from about 3 squared to around 30 squared. Make the parachutes and then do a trial run to check they drop properly. REMEMBER to do a control drop with NO parachute. Children drop the parachutes from a given height and are timed to reach the ground. If time, repeat (and repair) in order to have more accurate results. Now finish the investigation write up with the method, results (including line graph), conclusion and evaluation. Teacher mark. **Resources needed:** Plastic bag, string, Sellotape, cubes, scissors, timer. **Key terminology** - gravity, air resistance, friction, streamlined, pull, parachutes, fair test, variable, investigation, particles, surface area, method, conclusion.
5	**LI- I can identify the effect of water resistance that acts between moving surfaces.** **Comparative testing enquiry- Which shape of blu tac falls the slowest through water?** Show chn concept cartoon. Stick in and write down which ideas they agree with and why? Feed back to the class. Can chn explain their reasons? Recap previous learning e.g. objects passing through the air have air resistance to deal with! Friction and air resistance are therefore things that designers of things like cars and aeroplanes need to consider. But what about moving through water? Ask the chn to consider moving through water, mud and air up to their waists. Which would provide the most resistance to their movement? Why? Can chn think of any real life situations where they have had to do this? Tell the chn that air resistance can be a factor when running into the wind. In water however water resistance can hold us back! Discuss with the chn why not all creatures and objects have to move slowly through water. What can they tell you about fish, whales and boats that make them more able to overcome water resistance? In the same way that racing cars are designed to overcome air resistance on land many creatures are cleverly designed to overcome water resistance – this is sometimes known as streamlining. Set up a demonstration for chn. Weight two pieces of plasticine so that they have the same mass and roll them into a ball. Fill a tall clear cylinder with water and place it so that the children can see it. Tell chn that you are going to drop both balls from the same height at the same time. One into the water and one onto the table. Get chn to countdown... 3, 2, 1, Drop! What do they notice? *The ball in water falls slower than that falling through the air.* What is the explanation for this? *Water resistance slows the ball travelling through the water in the same way that air resistance can slow a parachute.* Tell chn that they are all going to be given a piece of plasticine which has the same mass. The challenge is to make it fall slower just by changing its shape! They are to measure their times remembering that each test needs to be fair! Chn should use stopwatches to time and then record each test. Encourage chn to refine the shape of their plasticine to slow down the rate of sinking even more! Allow chn in each group to share their results. Invite the slowest from each group to come to the front to find the overall class winners. Model how important fair testing and accurate measuring is throughout! When you have an overall slowest compare each to the ball tested in the demonstration. What do the chn notice? Remember - they are different shapes but the mass has stayed the same! Each of the shapes now has a different surface area. The larger the surface area the more water resistance and so the object is slowed. Objects with smaller surface areas can fall faster! Relate this idea to the air resistance experiments with sheets of card and parachutes in earlier sessions. Were the slowest shapes more or less streamlined? Chn write up their results and their conclusion explaining the science behind their results. Plenary- Show chn picture of the boat. What forces do they think are acting on it? Relate surface area to why some objects float and some sink. Water pushing up, object being pulled down by gravity (again not necessary to talk about balanced/unbalanced forces at this stage, though many will be aware of gravity). Whether it floats or sinks depends which force is greater. Peer assessment. **Resources needed:** concept cartoon, blu tac, water in a container, stopwatch, recording sheet **Key terminology**- forces, gravity, upthrust, friction, air resistance, water resistance, push, particles, surface area, float, sink, streamlined, buoyancy

6	**LI- I can recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.** Link to DT and Egyptians topic. Self assessment. **Resources needed:** https://www.neok12.com/Simple-Machines.htm; https://www.youtube.com/watch?v=oauDyIu_swM **Key terminology**- force, energy, load, effort, mechanism, simple machine, pulley, lever, gear, beam fulcrum/pivot, weight, fixed pulley, block and tackle pulley
7	**Assessment time** – Complete the final column of their KWL grid.