Mendell Primary School

Aspire Challenge Achieve

Medium Term Plan Design Technology

Year Group: 4	**Term:** Autumn #2 2021	**Teacher:** Hannah Jones	**Subject lead:** Catherine O'Neill Edwards	**Overview:** **Mechanical Systems – Pneumatics** Design, make and evaluate a toy for Year 1 pupils to help them understand that pneumatic systems can be used to create movement	**Key End Points:** **By the end of this unit children will be able to:** - create prototypes and explain why - investigate and use pneumatics
Links to other learning: Science: every day materials & their uses. Forces.	**Relevant Prior Learning:** Y1: sliders and levers + simple structures Y2:wheels+axles Y3: Levers + linkages. Science: states of matter	**Relevant Future Learning:** Y5: Mechanisms; CAMS Y6: Mechanisms; gears & pulleys	**High Quality Text:** Hydraulics for kids *James Koehntopp*	**Risk Assessment:** Take care as syringes may come out with force – especially when syringes are not the same size Use syringes that have come out of a sealed packet – discuss seeing a syringe in real life and what children should do as syringes can sometime be attached to needles to administer medication When using recycled materials ensure no allergies e.g. crunchy nut cornflake boxes with children who have nut allergies Scissor safety	**Teacher CPD:** Please read the DATA project on a page sheets attached at the end of this plan prior to teaching. Watch CPD video saved in MTP folder named CPD for teachers pneumatics https://www.youtube.com/watch?v=HzaWOFWVz6E Link above for further teacher CPD video – not to watch with pupils. https://www.technologystudent.com/despro2/expld1.htm explanation of what an exploded diagram is

	Learning Intention	Lesson Outline (Key Questions in colour)	Resources	Vocabulary	Lowest 20% Adaptations
1	• Investigate products with pneumatic mechanisms.	**This is a DT lesson. In DT we design and make to solve problems. The skill we will be using this lesson is investigating. We will be investigating a range of pneumatics** *If children demonstrate good understanding, session 1&2 could be completed together.* Recap from y3: What is a mechanism? Allow children to discuss. *Something that does a job or performs a task using moving parts.* The mechanism we will be learning about today are pneumatics. Our DT project this term is using pneumatics or hydraulics. What do we already know about hydraulics and pneumatics? Allow time for discussion and sharing ideas. Children sketch or note down thinking and ideas in their books. If the children do not have any base knowledge, do this at the end of the lesson when they have had time to investigate. To develop thinking, allow children to investigate further… Investigative and Evaluative Activities (IEAs) • Children investigate, analyse and evaluate familiar objects that use air to make them work e.g. bicycle pump, balloon, inflatable swimming aids, foot pump for inflating an air bed. Have a range of sources…. Real objects, videos, books etc https://studiousguy.com/compression-force-examples/ **it will take time to prepare these examples** What does the air do? How has it been used in the design of these products? How can air be used to move heavy objects? • Construct a simple pneumatic system by joining a balloon to 5mm tubing and then to a washing-up liquid bottle. What happens to the air when you squeeze the bottle? What happens when you let go? Can you lift a soft toy or a note pad using a balloon? • Demonstrate lifting an object and ask the children to think about ways in which this might be used in a product. Who might it be for? What is its purpose? What part moved and how did it move? What materials have been used? How effective do you think it is and why? What else could move? • Demonstrate a range of pneumatic mechanisms using prepared teaching aids including two syringes joined by plastic tubing; three syringes connected using a T-connector and using different sized syringes. What happens when the plunger of one syringe is pressed in? Why do the syringes move at different speeds? Note: take care as the syringe may come out with force. Discuss why, when pressing a large syringe, it can take time and feel 'squishy' before the smaller syringe is moved.	Everyday objects (or photographs) that use pneumatics/ hydraulics: bicycle pump, balloon, inflatable swimming aids, foot pump for inflating an air bed. Small, lightweight, toy Syringes: two the same size and one of a different size Tubing to connect the syringes (40-50cm lengths of plastic tubing, approximately 5mm diameter) Pre-made linkage Lengths of material (for example, metal or card) that are joined together by pivots, so that the levers (lengths) can move as part of a mechanism…. systems Masking tape A few books Some sandwich bags A box with a hinged lid	**Pneumatics** **Air** **Compressed** Hydraulics Liquid Space Move Volume Syringe piping	

		Discuss if the children have developed any thinking about what pneumatics and hydraulics could be? Record their books via sketching and notes). Discuss real life examples of both and record in books (or sticking in examples from magazines etc			
2	• Understand and use pneumatic mechanisms.	**This is a DT lesson. In DT we design and make to solve problems. The skill we will be using this lesson is investigating. We will then create a design brief** Continue Investigative and Evaluative Activities (IEAs) Demonstrate how to assemble the systems using syringes, tubing, balloons and plastic bottles. Introduce ways in which pneumatic systems can be used to operate levers. • Demonstrate the correct and accurate use of measuring, marking out, cutting, joining and finishing skills and techniques. • Provide the materials and ask the children to try out and draw the three systems they have been shown: a) Balloon connected to a washing-up liquid bottle. What happens when you squeeze the bottle? What happens when you let go? b) Two syringes of the same size connected together. What happens when you press the plunger of one syringe down? How far does the other syringe move? c) Two syringes of different sizes connected together. How far do these syringes move when pressed? Note: take care as the syringe may come out with force. Allow children to use water to see if there is any noticeable difference when using hydraulics – draw out positive and negatives for each through discussion. - Design, Make and Evaluate Assignment (DMEA) • Develop a design brief with the children within a context which is authentic and meaningful. • What is the purpose of the products they will be designing and making and who the products will be for? - Children record design before in books 'Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).' Example: design, make and evaluate a toy for Year 1 pupils to help them understand that pneumatic systems can be used to create movement *Ideas such as: tipper truck, jack-in-the-box, moving creature/monster, shop window display, moving toy, an assisted door for a Barbie/doll who is in a wheelchair, Santa going up and down a chimney.*	Syringes: two the same size and one of a different size Tubing to connect the syringes (40-50cm lengths of plastic tubing, approximately 5mm diameter) Pre-made linkage Lengths of material (for example, metal or card) that are joined together by pivots, so that the levers (lengths) can move as part of a mechanism.... systems Masking tape A few books Some sandwich bags A box with a hinged lid	**Pneumatics** **Hydraulics** **Liquid** **Air** **Compressed** **Design brief** Space Move Volume Syringe piping	
3	• I can generate design criteria focusing on the needs of the user. • I can use annotated sketches, exploded diagrams and prototypes to develop, model and communicate ideas.	**This is a DT lesson. In DT we design and make to solve problems. The skill we will be using this lesson is designing** *This lesson may need to extend over two sessions* Revisit design brief and develop design criteria that can be used to guide the development and evaluation of the children's products such as: - It should be colourful and appealing to a child - It should not include any small pieces that could be choking hazards - It should be well made and not easily broken - It should operate with a pneumatic system What is important to the user? What is it essential for the product to be? (safe) Explain to the children they will be expected to use thumbnail annotated sketches to record their ideas as they work (demonstrate what these are on the board and their purpose). What is a thumbnail sketch? A small drawing on paper Why are these useful? To explore ideas quickly. Encourage them to also create prototypes as they work (explain what a prototype is) What is a prototype? A practice model Why are prototypes useful? To learn from mistakes – see what works and what doesn't work • Using annotated thumbnail sketches and prototypes, ask the children to develop, model and communicate their ideas. Ask the children to generate a range of ideas, and explore, encouraging creative responses. Children will record their ideas as they work. Record on Y4 pneumatics design sheet - During session: walk around room and look at other children's thumbnail sketches and prototypes. What do they like? Could they magpie any idea? What works well? Are there any improvements that could be made? - Children now work on their final design. We also need to think about how it will be made and therefore we will be using an exploded diagram. See teacher CPD section if unsure. Demonstrate an exploded diagram for the children, explain clearly what the dotted lines demonstrate... dotted lines showing where the parts slide into place. Why are exploded diagrams/drawing useful? They show how a product is assembled and how the separate parts fit together. Children complete pneumatics design sheet 2. • Order the main stages of making: record clear steps as to how they will make their product listing equipment and resources needed.	Y4 pneumatics design sheet 1 & 2	**Design** **prototype** **Label** **Thumbnail** **Brief criteria** Idea Draw Sketch Explore Quickly Annotate	

4 & 5	.• Select and use appropriate tools with some accuracy to cut and join materials • Use finishing techniques suitable for the product they are creating.	**This is a DT lesson. In DT we design and make to solve problems. The skill we will be using this lesson is making or manufacturing our product safely** Making Arrange the children on tables according to the type of pneumatic system that they are using, they can share materials and support each other. Ask the children to collect all of the necessary materials for their pneumatic system and check that it works smoothly. Once the children have created the mechanism, they find materials for their housing: cardboard packaging, card. Remind pupils that they can draw their own nets for bespoke shapes if needed (CAD could be helpful here). The children must mark clearly where to attach the different parts of their mechanism: they must fit the balloon or syringes before they attach the moving parts of their toy. Once the children have finalised how the parts attach, they cut out the necessary pieces of card for hinges or moving parts. Hold the mechanism in place to test that it still works in the housing. Support the children in tweaking their mechanism to ensure that it runs smoothly. Discuss common problems and how to fix them with the class. Key questions to ask during the session: What is a pneumatic system? A system that forces air over a distance to create movement. Can you remember the three different ways to create a pneumatic system? How can you use pneumatic systems with linkage systems to create motion? Lengths of material (for example, metal or card) that are joined together by pivots, so that the levers (lengths) can move as part of a mechanism…. What products use pneumatic systems? How should you use scissors safely? Cutting away from your body slowly How can you use pivots to create motion? Using split pins What do we mean by 'housing'? Take photographs throughout manufacture process and of final product to put in books.	Syringes Tubes Connectors Balloons Bottles Tape Elastic bands Glue Scissors Pencils Paper fasteners or split pins Packaging recycled materials: egg cartons, tissue/shoe boxes	Pneumatics Hydraulics Liquid Air Compressed Space Move Volume Syringe Piping Hinges Housing Connectors mechanism	
6	• Evaluate products against design criteria • I can evaluate my product	**This is a DT lesson. In DT we design and make to solve problems. The skill we will be using this lesson is evaluating.** • Evaluate the final products against the intended purpose and with the intended user, drawing on the design criteria previously agreed. Have evaluation questions printed up and ask children to take a question and discuss it with a partner. -Did you make your product as planned? Does your design work? If not, do you know why? Did you have to change anything about the way you made your product? Does your product look how you intended? What was the best feature? What could be better? How would you adapt your design next time? How many stars out of 5 would you give your product and why? What was that the most difficult thing about the project? What have you learned? Does your product meet all your design criteria? (This will need to be tested with the intended user) Test out design criteria by giving to intended user (e.g. year 1) – spending time using it. Take photographs of product in action for books. Revisit design criteria and continue evaluation Encourage children to record evaluative statements in their books ensuring they all complete the question: Does your product meet all your design criteria? Encouraging them to give reasons and explain.	Evaluation questions printed in sets for tables Time for intended users to try out the product	**Evaluate** **Assess** **Improve** Design criteria Intention	