1. Year Groups

Year 3

2. Aspect of D&T

Mechanical systems

Focus

Pneumatics

3. Key learning in design and technology

Prior learning

- Explored simple mechanisms, such as sliders and levers, and simple structures.
- Learnt how materials can be joined to allow movement.
- Joined and combined materials using simple tools and techniques.

Designing

- Generate realistic and appropriate ideas and their own design criteria through discussion, focusing on the needs of the user.
- Use annotated sketches and prototypes to develop, model and communicate ideas.

Making

- Order the main stages of making.
- Select from and use appropriate tools with some accuracy to cut and join materials and components such as tubing, syringes and balloons.
- Select from and use finishing techniques suitable for the product they are creating.

Evaluating

- Investigate and analyse books, videos and products with pneumatic mechanisms.
- Evaluate their own products and ideas against criteria and user needs, as they design and make.

Technical knowledge and understanding

- Understand and use pneumatic mechanisms.
- Know and use technical vocabulary relevant to the project.

4. What could children design, make and evaluate?

tipper truck jack-in-the-box

moving creature moving toy

5. Intended users

younger children

6. Purpose of products

A product to sell to younger children/classes to generate an income for Year 3.

7. Links to topics/themes

Enterprise Project

8. Possible contexts

A toy for a smaller child

9. Project title

Design, make and evaluate a moving toy for a younger child (sibling) to generate an income for Year 3.

10. 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. *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. Ask the children: *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.

11. Related learning in other subjects

- **Spoken language** – participate in discussion and evaluation of examples of products that use pneumatics. Ask relevant questions to extend knowledge and understanding. Build technical vocabulary.
- **Science** – identify and compare the suitability of a variety of everyday materials for particular uses.

12. Focused Tasks (FTs)

- 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.

13. Related learning in other subjects

- **Spoken language** – ask relevant questions to extend knowledge and understanding.
- **Mathematics** – measure, compare, add and subtract: lengths, volume and capacity.

14. Design, Make and Evaluate Assignment (DMEA)

- Develop a design brief with the children within a context which is authentic and meaningful.
- Discuss with children the purpose of the products they will be designing and making and who the products will be for. Ask the children to generate a range of ideas, encouraging creative responses. Agree on design criteria that can be used to guide the development and evaluation of the children's products.
- Using annotated sketches and prototypes, ask the children to develop, model and communicate their ideas.
- Ask the children to consider the main stages in making before assembling high quality products, drawing on the knowledge, understanding and skills learnt through IEAs and FTs.
- Evaluate the final products against the intended purpose and with the intended user, where safe and practical, drawing on the design criteria previously agreed.

15. Related learning in other subjects

- **Spoken language** – ask relevant questions to extend knowledge and understanding. Build technical vocabulary. Consider and evaluate different viewpoints.
- **Art and design** – use and develop drawing techniques. Use colour, pattern, line, shape.
- **Science** – when evaluating, make systematic and careful observations and take accurate measurements.

16. Possible resources

examples of products and books, photos and videos showing pneumatic systems

washing-up liquid bottles, 5mm plastic tubing, sterile syringes, T-connectors, balloons

card, plastic sheet, PVA glue, masking tape, parcel tape, sticky pads, pipe cleaners, elastic bands, syringe clips,

left/right handed scissors, snips, card drills, cutting mats, hole punches, finishing media and materials

17. Key vocabulary

components, fixing, attaching, tubing, syringe, plunger, split pin, paper fastener

pneumatic system, input movement, process, output movement, control, compression, pressure, inflate, deflate, pump, seal, air-tight

linear, rotary, oscillating, reciprocating

user, purpose, function, prototype, design criteria, innovative, appealing, design brief, research, evaluate, ideas, constraints, investigate

18. Key competencies

problem-solving teamwork negotiation

consumer awareness organisation motivation

persuasion leadership perseverance

other – specify

19. Health and safety

Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

20. Web resources for teachers

https://www.youtube.com/watch?v=hZ4K0dQI3uQ no1 flick toy

https://www.youtube.com/watch?v=WJVXa31vB9c balloon powered boat

https://www.youtube.com/watch?v=F4_wgtkXTWU helicopter

https://www.youtube.com/watch?v=09VKxzk7aQE syringe nerf gun