Mechanical systems: Pneumatic toys > Year 3 > Lower Key Stage 2 > Design and technology > Lesson 2: Designing a pneumatic toy

Learning objective	Success criteria
• To design a toy that uses a pneumatic system.	• I can develop design criteria from a design brief. • I can generate suitable ideas using thumbnail sketches and exploded diagrams. • I can recall there are three different types of pneumatic systems that I can use to design my toy and use recycled household objects to make it. • I can recall that different types of drawings are used in design to explain ideas clearly.

Before the lesson

Watch

Teacher video: Designing a pneumatic toy

Have ready

- *Presentation: 3, 2, 1.*
- *Presentation: Sketches and diagrams.*
- Materials to show the children what they could use to make their toy (optional):
    - cardboard boxes or containers for the main body;
    - balloons;

- colouring pens or pencils;
- coloured card or paper;
- sticky tape;
- split pins.

- Link: STEM Inventions- Pneumatic design on Videolink.*
- Link: IKEA - Mammut children's table assembly.*
- Link: IKEA - Anilinare stationary holder assembly.*

*** These are external websites and we do not have control over their content – please check before showing them to the children.**

Print in advance

- Activity: Pneumatic toy design sheet one (one each - see Adaptive teaching).
- Activity: Pneumatic toy design sheet two (one each - see Adaptive teaching).
- Activity: Example sketches and diagrams (optional - see Adaptive teaching).

Lesson recap

Display the *Presentation: 3, 2, 1* and allow time for paired discussion.

Presentation: 3, 2, 1

1

Take feedback about any key points the children recalled from last lesson and anything they still want to find out about.

Attention grabber

The challenge for the children is to design and make a toy for Year 1 children to help them understand that pneumatic systems can be used to create movement.

Show the video on the link: STEM Inventions- Pneumatic design as an example.

Ask the children to discuss how they could adapt one of the pneumatic mechanisms explored in the previous lesson to make it their own. Encourage them to consider the materials that they would need to make it:

- Cardboard boxes or containers for the main body.
- Balloons.
- Colouring pens/pencils.
- Coloured card/paper.
- Tape
- Split pins, etc.

Explain that the children should think of a character to base their design on, which will make their toy more interesting.

Develop the tea box experiment from *Lesson 1: Exploring pneumatics* further by considering what other materials could be used – e.g. balloons, coloured paper or colouring pens and pencils. Design a simple character.

Ask the children discuss the task in small groups. Explain that they should identify four design criteria that a successful toy should meet, which should cover aesthetics, safety and function. For example:

- 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.

Hand out to each child either the *Activity: Pneumatic toy design sheet one* or the *Activity: Pneumatic toy design sheet two* (see Adaptive teaching) and ask the children to write the chosen class design criteria on their sheet.

Main event

Presentation: Sketches and diagrams

2

Display slide 1 of the *Presentation: Sketches and diagrams* and ask the children why they think drawing is important for designers and makers. Listen to their thoughts, and clarify the answers using slide 2.

Share slides 3 and 4 to compare examples of simple thumbnail sketches to a detailed drawing. Discuss how thumbnail sketches are good for quickly making sense of your ideas with rough sketches. Explain that detailed drawings are neatly illustrated, help communicate exactly what the product should look like, and suggest how it could work or be made.

Thumbnail sketches

Ask the pupils to sketch three ideas for a pneumatic toy on their design sheet. Explain that the sketch should involve either a backwards and forwards or up and down movement (e.g. a jack-in-the-box, moving scenery in a puppet theatre or Santa coming out the top of a chimney).

Emphasise that the sketches should be thumbnails rather than detailed drawings. Give the children a time limit, such as one minute of thinking time and two minutes of drawing time per idea.

Exploded drawing

Display slide 5 and explain that an exploded diagram can illustrate how different parts of a product fit together, giving a clear idea of exactly how to make it. Use slide 6 to show the children some real-world examples using the links: IKEA - Mammut children's table assembly and IKEA - Anilinare stationary holder assembly.

Discuss the purpose of exploded drawings and explain that the children need to choose the best idea from their thumbnail sketches.

Use slide 7 or demonstrate how to draw an exploded diagram, emphasising that the diagram does not need to be neat or to scale but it must communicate where the parts belong in relation to each other. They could add arrows and label the parts with the materials they will use or begin drawing a detailed version of their idea using slide 7 to support it.

Show slide 8 to illustrate how an exploded diagram differs from a detailed drawing for children who need further support.

Wrapping up

Allow the children to share their diagrams and ideas with the rest of the class and explain how it works.

Ask the children to provide feedback, including something they could improve or an alternative idea. Remind the children of the input and output arrows they drew on their diagrams in the previous lesson.

Vocabulary
Adapt Changing something so that it is suitable for a different use. **Exploded diagram** A diagram that shows all of the parts of a product, including the internal and external parts. **Pneumatic system** A mechanism that runs on air or compressed gas. **Thumbnail sketch** Small drawings to get ideas down on paper quickly.

Assessing progress and understanding	Differentiation
Pupils with secure understanding indicated by: identifying four appropriate design criteria, communicating two ideas using thumbnail sketches and communicating and developing one idea using exploded diagrams. **Pupils working at greater depth indicated by:** producing accurate and detailed designs with all parts and materials labelled.	**Pupils needing extra support:** Could use the examples on the *Activity: Example sketches and diagrams*; could use the *Activity: Pneumatic toy design sheet two;* should be encouraged to keep their ideas simple so that they can focus on creating a high-quality end product; could remove the time constraint suggestions on thumbnail sketches. **Pupils working at greater depth:** Should be challenged to draw with detail and accuracy, labelling the parts and materials in their design.