

Unit 3C Moving monsters

Focus – control: mechanisms

ABOUT THE UNIT

This unit helps to develop children's understanding of control through investigating simple pneumatic systems and designing and making a model of a monster that has moving parts controlled by pneumatics. This could be linked to stories or poems, or another purpose. A good context is toys to amuse children who are ill in bed. The designing and making assignment requires children to develop skills in working as part of a team.

The techniques used in this unit could be used in another context where something needs to be controlled by moving backwards and forwards or up and down *eg a tip-up truck, a jack-in-the-box, moving scenery for a puppet theatre.*

PRIOR LEARNING

It is helpful if the children have:

- learnt how materials can be joined to allow movement
- generated and communicated ideas in a variety of ways
- joined and combined materials using simple hand tools
- evaluated their work as it progresses and at the end

This unit builds on Units 1A 'Moving pictures', 2C 'Winding up' and 3A 'Packaging'.

It also builds on Science Units 1E 'Pushes and pulls', 2D 'Grouping and changing materials' and 2E 'Forces and movement'.

VOCABULARY

In this unit, children will use words and phrases relating to:

- designing *eg brainstorm, suggestion, evaluate, ideas, constraints, appropriate, graph, data, sort, order, set, label, title, list, probable, possible, impossible*
- making *eg planning, storyboard, components, fixing, tubing, syringe, attaching, finishing*
- knowledge and understanding *eg control, pneumatic system, pressure, inflate, deflate, input, output, pump, hinge, fastest, slowest, often, always, sometimes, never*

RESOURCES

- examples of products that use air *eg pneumatic toys, foot pump for inflating air mattress, balloon pump*
- washing-up liquid bottles, 5mm diameter plastic tubing, balloons, sterile syringes
- construction kits
- suitable reclaimed materials, card, plastic sheet
- materials for finishing *eg coloured papers, paint, papier mâché, fabric, foil*
- PVA glue, masking tape, parcel tape, lower temperature glue gun, pipe-cleaners
- scissors, snips

EXPECTATIONS

at the end of this unit

most children will:

have developed an understanding of simple pneumatic systems; have worked as part of a team to design and make a model monster with at least one moving part controlled by a pneumatic system

some children will not have made so much progress and will:

have developed a limited understanding of simple pneumatic systems; have needed support in working with others to design and make a model monster with a moving part controlled by a pneumatic system

some children will have progressed further and will:

have developed an understanding of simple pneumatic systems relating their work in the classroom to products in the wider world; have worked as part of a team to design and make a model of a monster that incorporates two or more moving parts controlled effectively by pneumatic systems, taking account of available resources

LEARNING OBJECTIVES

CHILDREN SHOULD LEARN

INVESTIGATIVE, DISASSEMBLY AND EVALUATIVE ACTIVITIES (IDEAs)

- how air pressure can be used to produce and control movement
 - techniques for making simple pneumatic systems
 - to compare the effectiveness of different systems
 - to use appropriate vocabulary to describe how things work
- Show the children familiar objects that use air to make them work *eg recorder, whistle, bicycle pump, balloon, inflatable swimming aids, foot pump for inflating an air bed, coiled party blowers. What does the air do? How has it been used in the design of these products?*
 - Construct a simple pneumatic system by joining a balloon to 5mm tubing and then to a washing-up liquid bottle. Encourage the children to investigate:
 - *What happens to the air when you squeeze the bottle?*
 - *What happens when you let go?*
 - *What happens if you put fabric over the balloon and then squeeze the bottle?*
 - *Can you lift a book with the balloon?*
 - Make a class collection of images of monsters for the children to refer to – real, fictional, scary or friendly, human, animal or alien.
 - Construct an alternative pneumatic system by joining two syringes with a piece of plastic tubing. Ask questions to help children investigate *eg What happens when the plunger of one syringe is pressed in? Compare the two systems and discuss their similarities and differences. (Note: take care as the plunger may come out with force!)*
 - Collect some small creatures *eg ladybirds, woodlice and caterpillars* and examine their bodies and legs using viewers and/or magnifying glasses.
 - Collect toy or model animals and creatures. Discuss how they have been made, in particular, how the colouring, markings and texture of the body parts have been replicated.

FOCUSED PRACTICAL TASKS (FPTs)

- how to assemble simple pneumatic systems
 - ways of fixing components
 - ways of using pneumatic systems in conjunction with simple levers to control movement
 - to explore ideas through 3D modelling
- Demonstrate techniques for assembling the two pneumatic systems used in the IDEAs.
 - Show children how balloons or syringes can be used in conjunction with simple levers to control movement *eg*
 - *place the balloon in a small box with a lid so that when inflated it raises the lid*
 - *use a card hinge to attach one of the syringes to a lever so that it can raise and lower the lever*
 - *explore the effect of moving the syringe closer to or further from the pivot point*
 - Provide children with components for making pneumatic systems, construction kits, pieces of card and plastic sheet with temporary fixings *eg masking tape*. Ask them to make a pneumatic system and explore using it with the other materials to make something move. Discuss the outcomes and highlight good ideas and solutions to any problems encountered.

DESIGN AND MAKE ASSIGNMENT (DMA)

Design and make a monster with moving parts controlled by pneumatic systems

- to work as a team
 - to choose an idea according to logistical constraints of materials, time, size
 - to think about their ideas as they make progress and be willing to change things if this helps them to improve their work
 - to plan through discussion
 - to work safely and accurately with a range of simple hand tools
 - to use a storyboard to record the sequence of their work
 - to evaluate as a team the product and purpose of improvements
- ★ Explain to the children the task, including constraints *eg time, size and materials* and the individual children's design input on aspects of the monster.
 - ★ Discuss with the children who the monster is for. *What does it have to do?*
 - ★ Discuss with the children possible ideas for moving parts *eg moving wings, opening and closing mouth* and for ways of making *eg using reclaimed materials for the structure*.
 - ★ Organise the children into small teams and ask them to brainstorm ideas, recording them in words and sketches. *What could you do? How could you do this? What do you need to know? What does this product need to do?*
 - ★ Ask each team to evaluate their ideas, choose one and explain how they are going to make it. *How could you do this? What could you use? What will it look like?*
 - ★ Ask each team to produce a list of the materials and tools they expect to use. *What will you need? Where will you work? Who will do what? What will you need to do first?*
 - ★ At certain stages, gather the children together to talk about their work so far, what they need to do next and share successful techniques and good ideas.
 - ★ During the work, ask the children to evaluate how they went about their work and the strengths and weaknesses of the finished product.
 - ★ Ask them to record their work in storyboard form showing how they made their monster.

- essential activities
- ★ assignment stages (all are essential)
- optional activities

LEARNING OUTCOMES

CHILDREN

- explain how simple pneumatic systems work using appropriate vocabulary
- are familiar with techniques for making simple pneumatic systems
- discuss how products have been made, and how models replicate real-life features

- construct effective pneumatic systems
- know of techniques for fixing components
- investigate ways of using their pneumatic systems with other materials to control movement

- apply what they have learnt through IDEAs/FPTs in their designing and making
- work together on an appropriate idea generated through brainstorming and discussion of the constraints
- plan the stages of their work and record these at the end of the project in a storyboard
- work safely and accurately with a range of simple hand tools
- know how to evaluate their product as a team and suggest improvements

POINTS TO NOTE

Links to this unit

Design and technology: Units 4B 'Storybooks' and 5C 'Moving toys'

Science: Unit 4E 'Friction'

Information technology: Units 3A 'Combining text and graphics', 5E 'Controlling devices', 6C 'Control and monitoring – What happens when...?'

Mathematics: Position and direction (opposite, along, through, middle, edge, next to), measurement (standard, non-standard units)

Speaking and listening: Teach discussion skills to help children reach an agreement about what is to be done and so that they can evaluate their work *eg developing a list of key questions to ask themselves, teaching phrases like 'could have' and 'if' to signal tentative thoughts*

Content

- Have examples of simple systems made up so that the children could use them for investigation purposes before making their own.
- Make sure that the tubing is the right size and that air is not escaping from the system. Parcel tape could be useful for sealing the connection between the plastic tubing and the 'squeezy' bottle nozzle.
- When children use syringes, they may well notice that movement at the input is not always instantly matched by movement at the output. This is because air is 'springy' and has to be squashed some way before it starts to move.
- When attaching syringes to levers it is usually necessary to have a flexible joint *eg a card hinge* to ease the movement.
- Children could use syringes of different sizes to vary the input and output *eg a large syringe used as the input will move a small syringe further.* (See safety point below.)

Class management

- Teams of between two and four children are recommended for this activity. The way that this is organised will depend on children's previous experience of teamwork. Allocate times during the designing and making assignment when the team discusses the progress of the work. Give the team specific tasks *eg writing a list of jobs to be done and putting them in order or identifying what is working well/not working well.*
- The designing and making assignment could be made more tightly focused, if appropriate, with the teacher negotiating very specific constraints and criteria. Alternatively, teachers could limit the number of techniques introduced to the children.

Health and safety

When carrying out a risk assessment for this activity, teachers will need to consider the materials, tools and equipment being used.

In addition, the following points should be noted:

- make sure components are clean and always use sterile syringes that have not been used for medical purposes
- syringe plungers can come out with force, particularly when the syringe being pressed (input) is larger than the syringe being controlled (output)

Out-of-school activities and homework

Children could find out about other air-operated equipment *eg automatic doors, dentist's drill.*

