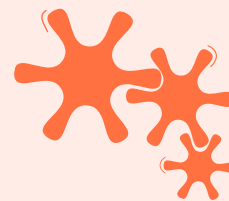


Spirit of Innovation

STEAM Resources



Engineering

Year Four

Pneumatics and Hydraulics

Under Pressure

Links

Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. They should work in a range of relevant contexts [for example, the home, school, leisure, culture, enterprise, industry and the wider environment].

When designing and making, pupils should be taught to:

Design

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups
- Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

Make

- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately
- Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate

- Investigate and analyse a range of existing products
- Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work
- Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge

- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures
- Understand and use mechanical systems in their products
- Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]

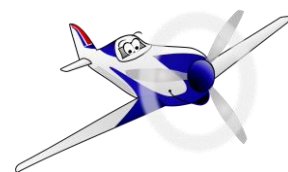
Resources

- Scissors
- Glue
- Sticky tape
- Glue Gun
- Split pins
- Lolly sticks
- Cardboard
- Paper
- Drinking straws
- Wooden wheels
- String
- Shoe boxes/sturdy boxes
- Hole punch
- Recycled material
- Paint
- Pens
- Balloon
- Plastic tubing
- Syringes - 20ml, 10ml & 5ml
- Water
- Food colouring
- Stop watch
- Data Recording Sheet x 2 ([Download](#))
- PowerPoint – Hydraulics & Pneumatics ([Download](#))
- Blueprint Design Sheet ([Download](#))
- Spirit of Innovation Race Maze ([Download](#))

Suggestion for materials



PIONEERS OF POWER



Skills

- Working as an individual
- Working as a pair
- Communicating thoughts and ideas
- Predicting outcomes
- Selecting suitable tools and materials
- Understanding hydraulics and pneumatics and their output
- Demonstrate a range of joining techniques
- Improving and evaluating designs

Questions

- What is the difference between pneumatic and hydraulic?
- What do you think will happen to the syringe when you push the plunger?
- Where have you seen pneumatic and hydraulic being used in the wider world?
- Why do we require pneumatic and hydraulic?
- What materials are you going to use?
- What tools will you require? Why?
- What will you use to join each material? Why?
- What pneumatic system will you be using? Syringe/balloon

Activity

Activity One

Pairs
(40 - 60mins)

PowerPoint – Hydraulics & Pneumatics to follow this session

Data Recording Sheet x 2 Pneumatic and Hydraulic ([Download](#))

In pairs explore a variety of different sizes syringes. (Suggested 20ml, 10ml & 5ml)

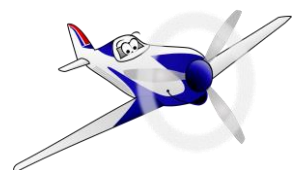
Starting with a 20ml syringe; pull back the plunger, cover the other end with your finger and then push the plunger down.
What happens when you let go of the plunger? What happens when you take your finger off?

Next; attached a 20ml syringe to some plastic tubing. Pull the plunger back on another 20ml syringe, then attach it to the other end of the tubing.

*What will happen to the first syringe when you push the plunger in on the second one?
What do you notice about the distance each syringe moves?*

Now change one of the 20ml syringes for a different size of syringe and repeat the activity.
*Will the syringes move the same distance each time? Explain...
Do you think there is a connection between the size of the syringe and the distance they move?*

Record your findings using the Data Recording Sheet – Pneumatics



Finally repeat the activity using water (hydraulics) record results on the Data Recording Sheet - Hydraulics

What so you think is going to happen?
What do you notice about the results?

PowerPoint – Hydraulics & Pneumatics ([Download](#))

Activity Two

Pairs/Small Group
(40 - 60mins x2)

Discuss with the class, the findings of the previous session and the Pneumatic and Hydraulic PowerPoint.

Explain that in pairs, or small groups, they are going to design and make their own plane incorporating a pneumatic system.

In keeping with The Spirit of Innovation Project the main body of the plane needs to be created out of recycled materials.

The undercarriage of the plane needs to drop down using a pneumatic system – either by using pairs of syringes and plastic tubing or by inflating a balloon and pupil blowing through plastic tubing.

Using the Blueprint Design Sheet ([Download](#)) design and label their plane. Communicate their ideas through group discussion, annotated sketches, cross-sectional and exploded diagrams. Listing the materials required and clearly presenting the workings of the pneumatic system.

** There is an option to include lights at this stage, as part of the DT curriculum. Also ties in well with Science – Circuits.*

Once a design has been agreed and resources gathered, the plane can begin to be constructed.

During the creating stage pupils should ensure that they are evaluating their joining technique. Looking at strengthening, stiffening and reinforcing their more complex structures. Next pupils should begin to devise the mechanical system that will move the undercarriage. ** Plus, any circuitry if lights are being included.*

Throughout the two sessions pupils should be given time to evaluate theirs and others models, using this knowledge they will be able to make adjustments to improve their work.

Activity Three

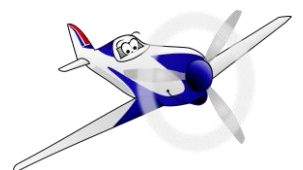
Pairs/Small Group
(40 - 60mins x2)

<https://www.youtube.com/watch?v=tixPi19VlsU>

This can be made in addition to/or instead of the Spirit of Innovation plane.



PIONEERS OF POWER

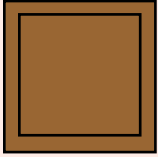


Using the lid of a box and recycled materials construct a Spirit of Innovation Race Maze.

Grid and/or images available if required ([Download](#))

Using a hot glue gun attach a syringe to each corner or the lid/maze.

Using a separate piece of cardboard, draw around the lid and then add a 2cm border. Cut around this border.



Place the plungers into the 4 corner syringes, turn the maze upside-down. Using the hot glue gun put glue on the end of the plunger. Place the piece of cardboard onto of the glued plungers. Once dry turn back over.

Attach plastic tubing to the corner syringes. Add 4 further syringes to each end of the tubing.

Use coloured tape to pair the syringes. (pneumatic)

If water is being used food colouring can be used to identify the pairing. (hydraulic)

As the Spirit of Innovation plane is aiming to break a record, pupils could use a stop watch to time their runs - getting the ball from the START to the FINISH is 'record' time.



PIONEERS OF POWER

