



# Lesson Activities

John Boyd Dunlop



## Lesson Activities

In this lesson the children will explore the power and uses of pneumatics. For the lesson they will use balloons and syringes to learn more about pneumatics.

The equipment you need for the lesson is listed below:

- inner tube from a bicycle
- bicycle pump
- balloons
- a variety of plastic syringes in different sizes
- a length of plastic tubing
- Milton fluid (for sterilizing)
- small cardboard boxes

### Bicycle Tube

Ask children to re-read the section from the 'Our Innovators' website where John Boyd Dunlop creates the tube for his son's bicycle.

Show them the inner tube from a bicycle and explain that these are now contained in all bicycles. Ask for a volunteer to come to the front of the class and blow up the tube. Before they start, ask the children to predict what changes will happen to the tube as the pupil blows it up. While the tube is being inflated ask children to describe the changes that are taking place.

When the tube is fully inflated, invite children to hold and squeeze the tube. Ask them to think about the tube inside the bicycle tyre. What would it be like to ride the bike when the tube is deflated? What would it be like when fully inflated?

Ask them to think about what has made the difference between the inflated and deflated tube. Draw out the fact that the difference has been made by the amount of air that is trapped inside the tube. Explain to them that anything using the force or pressure of trapped air is called **pneumatic**.



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## Investigating Pneumatics

Set up three stations around the room (you can duplicate the stations if you wish to split children into smaller groups).

- Station 1 will have a number of balloons and a number of books (up to 10).
- Station 2 contains a number of syringes.
- Station 3 will have pairs of syringes connected by the plastic tubing. Pair most of the syringes with others of the same size but pair a few together that are different sizes.

Split the class into groups and explain to the children they are going to rotate around the stations in the room and carry out investigations. At each station they should complete the investigation sheet (Resource 1). They will make predictions about what will happen and make notes on what happens during their investigation. Give each group 10–15 minutes at each station.

## Setting up the Stations

More information is available in Resource 1.

### Station 1

Place a balloon underneath two books (with more books at the side of the table). Ask the children to predict what will happen if they blow up the balloon, and how many books the balloon may lift up. Ask the children to use a different balloon (of same size) if they are taking turns to blow up the balloon.

### Station 2

Place a number of syringes at the station (one for each child). The children must take a syringe and lift the plunger. Then they should cover the end of the syringe with their finger and press down firmly on the plunger. What do they feel? How difficult is it to push? The children then release the end of the plunger – they should record what happens (the plunger shoots back up). They should discuss why they think this happens (the trapped air is pushing the plunger back up).



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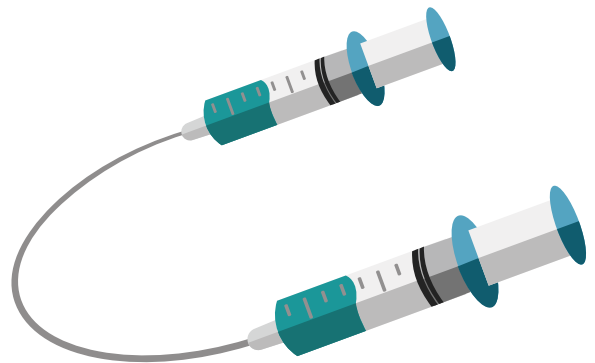


## Station 3

Join together a number of syringes of the same size with the plastic tubing. Push the end of one syringe fully in and attach the plastic tubing to it, then push the plunger of the other syringe slightly in and connect the plastic tubing to its end.

Do the same for a few syringes of different sizes.

Ask the children in pairs to take hold of a pair of syringes of the same size. They will predict and test what will happen when they push in the plunger of one of the syringes. Ask them to note how far each syringe plunger moves and why they think that happens.



They then must try the same experiment with pairs of syringes of different sizes. What differences would they expect to see?

## Feedback

When each group has had a chance to rotate around each station, ask the class to come together and give feedback on what happened.

## Pneumatic Jack-in-the-Box

Divide the children into groups of four or five. Tell them that they are going to design and build a 'Jack-in-the-Box' toy that uses pneumatics. Ask them to plan out how they will make the 'Jack' push the lid of the cardboard box up. If you don't have cardboard boxes, provide the children with a net so that they can create their own box. They can use any combination of the balloons, syringes and plastic tubing to make their 'Jack-in-the-Box' work. If they are using the plastic tubing to blow the Jack out of the box, remind them to clean the end of the tube with the sterilizing solution after each child uses it.



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## Dunlop's Pneumatic Tyre

Ask the children to think about Dunlop's invention of the pneumatic tyre again. After doing their experiments, ask them if this helps them explain how Dunlop's tyre works. Ask them to think of other examples where pneumatics is used (cars, buses). What sort of difference did Dunlop's invention make? Why was it so important? Finally ask them to draw a diagram of the bicycle wheel and to add labels to the diagram showing how the pneumatic tyre works.

They then must try the same experiment with pairs of syringes of different sizes. What differences would they expect to see?

## Feedback

When each group has had a chance to rotate around each station, ask the class to come together and give feedback on what happened.

## Reflection

Ask the children if they have learned anything new about Ulster-Scots or innovation while doing this lesson. Encourage them to add to the KWL grid that they created in the 'Let's Plan' lesson.



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## What's Next?

