LOCATION:	TARGET AGE GROUP:
Classroom	KS2
TARGET GROUP SIZE:	**DURATION:**
10-20 (scale resources for larger group)	Min. 1 hour (ideally 1.5 hrs)

PLPS CITY SCIENCE STARS

Fixture 9: Feel the Pressure

SUMMARY:

Pupils will learn about different forms of pressure and how they are applied in sport and everyday situations. Pupils will carry out a hands-on investigation into the relationship between the air pressure of footballs and their bounciness. Pupils will also then see what happens to footballs that are taken up mountains with low atmospheric air pressure, as well as a demonstration of how a build-up of air pressure can be used to launch mini fizz-rockets.

LEARNING OBJECTIVES:

1. To learn about different types of pressure and how are applied
2. To learn how low and high air pressure affects footballs and other objects

PRIOR LEARNING AND LINKS TO KS2 NATIONAL CURRICULUM:

- ✓ Pupils will be learning about the effects of gravity and air resistance on objects.
- ✓ Pupils will be working scientifically and carrying out experiments.

PREPARATION AND RESOURCES: (ASSUMING GROUP SIZE OF 16):

- ✓ This workshop works best with the use of a computer and projector or a computer-linked smartboard to display the 'FEEL THE PRESSURE' PowerPoint slides. If none are available, printouts could be used instead, but these will be less engaging and less environmentally friendly.
- ✓ 'FEEL THE PRESSURE' report sheet inside their lab book.
- ✓ Footballs of various internal air pressure (for example, ranging from 0.5 to 25 psi)
- ✓ Tape measures
- ✓ Film canisters
- ✓ Effervescent tables such as Alka-Seltzer
- ✓ Protective goggles and fizz-rocket launching tray

LOCATION:	TARGET AGE GROUP:
Classroom	KS2
TARGET GROUP SIZE:	**DURATION:**
10-20 (scale resources for larger group)	Min. 1 hour (ideally 1.5 hrs)

ACTIVITY PLAN:

Introductory activity

1. Ask the pupils when they might feel the effects of pressure during a football match, providing a range of photos from football situations that exemplify emotional or social 'pressure' such as the taking of a penalty, matches with large cheering crowds or when a player is injured. They will likely mention scenarios related to the ones in the photos, and confirm that these all involve pressure, but not the sort of pressure that we will be investigating during the session.
2. Show the pupils the short video clip of a football player having a football bounce off their face and explain that this is due to physical pressure.

Main activity (small groups of 3/4 students)

1. Show the pupils the collection of balls that are labelled with numbers relating to their internal air pressure and demonstrate how to measure the height of the bounce using the tape measure.
2. Allow the pupils to determine the specifics of their investigation (e.g. drop height, drop force, when and how to measure the bounce) and let them choose one of the balls to start with.
3. Once they've measured the bounce height of their football three times, they can swap their ball for another one. Encourage them to select balls with a wide range of air pressures so that they can detect differences across a wide scale, not just from a small range of similar balls.
4. Ask the pupils to write down their measurements, calculate the medians and draw their conclusions.
5. They can also draw simple bar graphs using the median values.

Plenary activity

1. Ask the children what they think might happen to a football that is taken up a mountain where the external air pressure is much lower than at sea level. They might say that the ball will go flat, but you can then show the photo of Dr Suzie Imber holding up the football on the mountain and explain how the circumference grew by 5cm due to the increased internal pressure relative to the low outside air pressure.
2. Now you can demonstrate what happens when air pressure increases and how this effect is used to launch rockets. Fill a film canister with a small amount of water (less than ¼ of the volume) and place in the launch tray. Break an effervescent tablet in half and place in the canister, then quickly secure the lid and flip the canister upside down. Wait approximately 15-20 seconds for gas to build up inside the canister and you can spend this time explaining what is happening. Then the increased pressure will cause the lid to pop off and send the canister flying into the air.

TAKE HOME CHALLENGE IDEAS:

- Prompt children to experiment at home with air pressure. For example, they can try and trick their parents by rolling up a small ball of paper and putting it in the mouth of a plastic bottle on its side, then challenging them to blow the paper ball into the bottle. This will likely prove to be impossible due to Bernoulli's principle and if anything, the paper will probably pop out of the bottle towards the blower. The air pressure inside the bottle increases as more air is blown in and this pushes the paper out.

LOCATION:	TARGET AGE GROUP:
Classroom	KS2
TARGET GROUP SIZE:	**DURATION:**
10-20 (scale resources for larger group)	Min. 1 hour (ideally 1.5 hrs)

TASK/ASSESSMENT DIFFERENTIATION:

✓ **Minimum student goals:**

- Measure the difference in height between two footballs of different pressures when bounced

✓ **Target student goals:**

- Measure the difference in height between a range of footballs of different pressures when bounced

✓ **Further goals:**

- Discuss the reasons why higher air pressure makes the ball bounce higher

PUPIL MONITORING AND EVALUATION:

- During the main activity, help the pupils conduct their investigations and ask them questions about their predictions and findings.
- At the end of the main activity, ask each group if their predictions were correct and how they can apply their findings to the footballs used in r eal matches.

DELIVERY NOTES AND ADDITIONAL SCIENTIFIC INFORMATION::

Vocabulary:

- Pressure, density, concentration, chemical reaction.