The Secret World of Gases family show

Overview

The Family Show for The Secret World of Gases is flexible and modular so you can adapt the length to suit your needs. We are giving you 18 Gas activities and if you were to run them all together it would create a show of 45 minutes. We know most science centres have family shows that are around 20 - 30 minutes in length, and below we give you a list of all the activities, and which we would recommend and the running order for two 20-minute family shows, and a 30-minute family show.

We are also providing you with a PowerPoint template including title slides and content slides, which you can use as provided or modify to your needs. We ask that if using PowerPoint, you use the branded Secret World of Gases slide format.

The slides are available on the project website **www.secretworldofgases.org**

The List of all the Activities

1. Gas bingo
2. Shrinking balloons*
3. Liquid air*
4. Liquid nitrogen fountain**
5. Boiling nitrogen*
6. Keeping food fresh
7. Blazing wotsits**
8. Plane oxygen**
9. Capturing carbon dioxide**
10. Absorbing heat
11. Sublimating carbon dioxide*
12. Ocean acidification
13. Making hydrogen**
14. Hydrostik
15. Hydrogen fuel cell
16. Hydrogen powered car
17. Hydrogen powered bus
18. Hydrogen house

*activities that require some ventilation
**activities that require some ventilation and a high ceiling (suggested at least 3m)

Family show suggestion 1: 20 minutes

1. Gas bingo
2. Shrinking balloons or Liquid air*
3. Keeping food fresh
4. Plane oxygen**
5. Capturing carbon dioxide**
6. Sublimating carbon dioxide*
7. Making hydrogen**
8. Hydrostik and Hydrogen fuel cell
9. Hydrogen powered bus
10. Hydrogen house

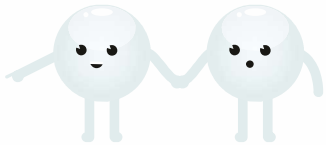
Family show suggestion 2: 20minutes

1. Gas bingo
2. Liquid nitrogen fountain**
3. Boiling nitrogen*
4. Blazing wotsits**
5. Capturing carbon dioxide*
6. Absorbing heat
7. Ocean acidification
8. Hydrostik and Hydrogen fuel cell
9. Hydrogen powered bus
10. Hydrogen house

These two show options both begin with Gas bingo and end with the Hydrogen house, and look at a range of gases covered by the programme using different demonstrations. The first suggested running order includes generating both hydrogen and oxygen using chemical reactions, and the second suggested running order looks at carbon dioxide in more detail.

Family show suggestion 1: 30 minutes

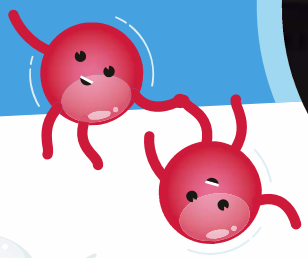
1. Gas bingo
2. Shrinking balloons or Liquid air*
3. Liquid air*
4. Keeping food fresh
5. Plane oxygen**
6. Blazing wotsits**
7. Capturing carbon dioxide**
8. Ocean acidification
9. Making hydrogen**
10. Hydrostik
11. Hydrogen fuel cell
12. Hydrogen powered bus
13. Hydrogen house

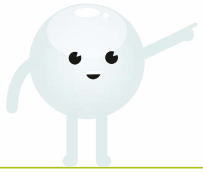


The 30-minute family show goes into more detail on carbon dioxide, and also includes generating both hydrogen and oxygen. With this option you can also go into more detail when explaining the hydrogen fuel cell and Hydrostik, before using hydrogen to power the bus and house.

How to run the family show

Activities 1- 18





Gas Bingo (activity 1)

This is a great demo to introduce the concept that the air around us is made up of many different gases. It also introduces families to many of the gases in the show.

Key Concepts

1. What actually is a gas and how are the particles arranged.

2. There are many gases in the air around us, including nitrogen, oxygen and carbon dioxide.

3. Nitrogen and oxygen are the two main constituents of air, together accounting for 99% of air around us.

Activities with liquid nitrogen (activities 2 to 5)

Once nitrogen has been introduced as being all around us, we can use liquid nitrogen to discuss states of matter, the particle model of matter, and explore some of the properties of this amazing cryogenic substance.

The 'Shrinking balloons' demo shows the cryogenic effect liquid nitrogen can have on gases, by condensing liquid air. This demo and 'Liquid air' can also be used to discuss the different gases in the air by their different boiling points.

'The Liquid nitrogen fountain' is a very visual demonstration of some of the properties of liquid nitrogen and its impact on other materials, and 'Boiling Nitrogen' is a good way of getting the nitrogen gas needed for the 'Keeping food fresh demo' (activity 6).

Many of these demos have various Health and Safety considerations, so please check these carefully in the relevant activity pages.

Key Concepts

1. The main states of matter of a substance are solids, liquids and gases, and we can transition between these by adjusting the temperature of the substance.

2. Matter is made out of tiny particles called atoms, and how these atoms are arranged affects their properties.

3. Liquid nitrogen is extremely cold. Its boiling point (temperature at which it becomes a gas) is -196 degrees centigrade.

4. Liquid nitrogen is used as a cryogenic substance.

Gases to preserve food (Activity 6-8)

Nitrogen is used inside some food packaging to keep food fresh, including inside packets of crisps and bagged salad. If food was packaged in air, because it contains more oxygen, this would trigger a chemical reaction between enzymes in the apple to create the discolouration demonstrated in 'Keeping food fresh (Activity 6). It will be used increasingly in the future as food becomes more scarce. Nitrogen is also used as a quick-freezing agent and is commercially important as a fertiliser.

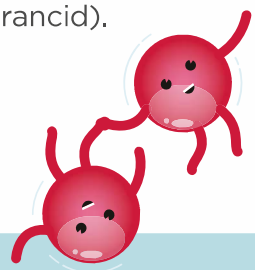
Key Concepts

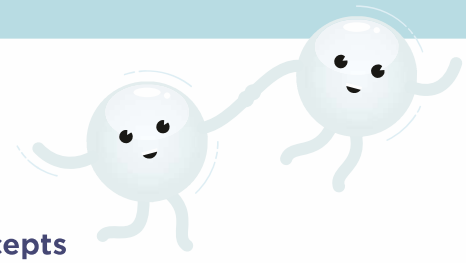
1. Nitrogen can be used in food packaging instead of air because it preserves the food which would oxidise in air. It is just one of a wide variety of modified atmosphere packaging gases used.

2. Nitrogen is a major component in fertilisers, as well as in the manufacture of industrial chemicals ammonia and nitric acid.

Activities with oxygen (Activities 7-8)

Oxygen is the second most abundant gas in the air we breathe, and essential to human, plant and animal respiration. It's also a very effective oxidising agent, which means it can be very reactive. Rapid oxidation of many materials in air is what we call burning, but rusting and some aspects of rotting are also examples of oxidation (for example browning of fruits or oils becoming rancid).





Key concepts

1. We need oxygen to live and breathe, we breathe it in to release energy stored in the food we consume.

2. Oxygen can be a very reactive gas.

3. In aeroplanes in an emergency, masks drop down to supply oxygen. This oxygen is chemically generated when needed from a reaction between sodium chlorate and iron powder.

Activities with Carbon dioxide (activities 9-12)

Carbon dioxide is the fourth most abundant gas in the air that we breathe, and is exhaled by humans and animals. It is also a greenhouse gas. In the last 100 years, its level in our air has risen from 0.003% to 0.004% and since 1958, carbon dioxide concentrations have increased by 24%.

Key concepts

1. Atmospheric mapping of the globe shows that in Spring, large forests act as a major carbon sink. The pattern changes with the seasons and the growth of the vegetation.

2. Because it's a less reactive gas than oxygen and is odourless, it can be used in packaging in a similar way to nitrogen.

3. Exciting possible future uses include using waste carbon dioxide to ripen fruit and vegetables, or converting carbon dioxide into hydrocarbon-based fuels.

Activities with hydrogen (activities 13-18)

Hydrogen is the most abundant element in the universe, but it exists on Earth primarily as a component of other molecules such as water. Hydrogen can be produced chemically by reacting metals with acids to produce a metal salt and hydrogen gas.

Hydrogen is also a major component in naturally occurring hydrocarbons and water. Hydrogen can be released from steam-reforming hydrocarbons, but this has the disadvantage of still using non-renewable sources and producing carbon dioxide as a by-product. A cleaner method of generating hydrogen is by splitting water with electricity from renewable sources .

Hydrogen has a great potential as a future fuel. It can be produced in one place and put into a car or bus where it is used, creating only a small amount of water vapour as an emission. In this way it acts as an energy vector, ensuring that clean energy can be used at the point of need, and has specific applications for use in city streets where pollution from particulate matter creates a major air quality issue.

Key concepts

1. Hydrogen is an energy vector, so clean fuel can be used where needed.

2. The energy stored in hydrogen gas can be released in the form of electric charge by recombining hydrogen with oxygen to form water in a fuel cell.