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| **Frozen bubble winter challenge** | | |
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| **Stay safe** |  |  |
| Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for:  • ensuring that any equipment used for this activity is in good working condition  • behaving sensibly and following any safety instructions so as not to hurt or injure yourself or others  Please note that in the absence of any negligence or other breach of duty by us, this activity is carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠ | | |
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| **Age range:** 11-14-year-olds or younger with adult supervision  **Approx. time:** 45 minutes – 1 hour |  | **Key words / Topics:**   * material * state * evaporation * molecules * liquid * solid * gas * plasma |
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| **Introduction** |  |  |
| It’s fun to blow bubbles but they usually don’t last very long and are very easy to pop. In this activity learners are going to create a frozen bubble which might last a little longer – well, until it melts! | | |
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| **Equipment** ⚠ |  |  |
| * Water * Golden syrup * Washing up liquid * A straw (make sure it’s biodegradable) * A mixing bowl * A smaller bowl | | |
| **Instructions** ⚠ |  |  |
| **Step 1**  Measure 2 tablespoons of water into a bowl.  **Step 2**  Add an equal amount of washing up liquid and golden syrup and gently stir.  **Step 3**  Pour some of the mixture into the smaller bowl. Use the straw to blow bubbles into the mixture in the smaller bowl.  **Step 4**  Place in the coldest part of freezer. If it has been snowing or the temperature outside is below freezing, learners can blow bubbles outside onto the grass.  **Step 5**  Wait for 10 minutes, then check the bubbles to see if they have frozen. | | |
| **Science and maths** |  |  |
| **Bubbles**  Bubbles are made from a sandwich of soap and water around a pocket of air. They are always round because a sphere is the smallest, most efficient shape. A fascinating fact is that if they stack together they form hexagon shapes in the same way as honeycomb in a beehive!  **States of matter**  All things can exist in one of four states: **solid**, **liquid**, **gas** or **plasma**.  The water we drink, which comes from the tap, is a liquid. When it is heated up it **evaporates** and becomes steam - which is a gas. Alternatively, when the water is cooled down it becomes ice, which is a solid. These changes happen because of the way the **molecules** in water, or any other substance react to heat. When molecules are heated up, they begin to move and jiggle about - this makes them flow more easily. If they are heated even more, they will move even faster and the distance between each molecule will become greater - this creates a gas. When they are cooled – like in this activity – they have less energy and become solid.  So why isn’t everything around us in the same state? Water is liquid but a metal fork is solid. The answer is that different materials have different temperatures at which the molecules will change state. Water will turn into a gas at 100 degrees Celsius and freeze at 0 degrees Celsius, but a metal like tungsten will need to reach 5,555 degrees Celsius before it will start to boil. | | |

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| **The Engineering Context** | |
| Understanding how states of matter change is necessary in many areas of engineering. For example, many products are made by casting – this involves melting material, pouring it into a mould of the shape required and re-freezing it in that shape. This understanding also underpins the use of heat exchangers and air conditioning equipment. | |
| **Curriculum links** | |
| **England: National Curriculum**   * **Science: upper KS2** * Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.   . | **Northern Ireland Curriculum**   * **Primary: the world around us** * Materials can exist in different states. |
| **Scotland: Curriculum for Excellence**   * **Science second** * I can apply my knowledge of how water changes state to help me understand the processes involved in the water cycle in nature over time. | **Wales: National Curriculum**   * **Science, the sustainable earth** * The properties of solids, liquids and gases and how the particle model can be used to explain these properties. |