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| **Make an exploding snowman** | | |
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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: ⚠ | | |
| **Age range:** 7-11+  **Approx time:** 1 hour |  | **Key words / Topics:**   * Science experiment * Changes of state * Chemical and physical reactions (advanced extension) |
| **Equipment** |  |  |
| * A zip-lock bag (sandwich bag size is great to start off with) * Permanent markers * Baking soda * White vinegar * Kitchen roll | | |
| **Instructions** |  |  |
| **Step 1**  Decorate the ziplock bag to make it look like a snowman’s face. It’s your snowman so you can make it look however you want but here is an example:  **Step 2**  Take a piece of kitchen roll and put three teaspoons of baking soda on it. Wrap it up like a package so that it can’t fall out.  **Step 3**  Place the kitchen roll package into your ziplock bag, taking care that it doesn’t open and spill out the contents.  *(You might want to put the bag into a sink or a tray or even do it outside now because it will get very messy!)*  **Step 4**  ⚠You might need some help for this next bit.  Pour 2 cups of vinegar into the zip-lock bag and VERY QUICKLY seal it. Put it in the tray and stand back. It should swell up very quickly and explode.  Check out the exploding snowman video in Santa’s STEM Workshop online. | | |
| **Extension** |  |  |
| Now you know the method, you can experiment with different sizes of zip-lock bags and different amounts of baking soda and vinegar.   * What happens if we use a larger or a smaller bag? * What if we keep the amount of baking soda the same but double the amount of vinegar? * What if we double the amount of baking soda but keep the amount of vinegar the same? | | |
| **Science** |  |  |
| Physical reactions are when something changes state. This means from a solid to a liquid, or to a gas such as water. Water changes state from a frozen solid (ice) when it melts to become a liquid and can be poured. When we boil water we get water vapour, which is a gas.  Physical changes are **reversible** because the substance changes without becoming a new chemical.  See this video to explore how particles are arranged in solids, liquids and gases: <https://www.bbc.co.uk/bitesize/clips/zx64wmn>  and this one to explore their properties <https://www.bbc.co.uk/bitesize/clips/zjbxn39> | | |

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| **Extension for KS3+** |  |  |
| Chemical reactions are **irreversible** because the substance changes into new chemical elements or compounds. (For example, when we bake a cake, we can’t get the original ingredients back.)  See this video for more information <https://www.bbc.co.uk/bitesize/topics/zypsgk7/articles/zwxhk2p>  When we add baking soda to vinegar, we cause both a chemical reaction and a physical reaction.  In the chemical reaction when we add our base compound sodium bicarbonate (baking soda) to our dilute acetic acid solution (vinegar), the hydrogen ions in the vinegar react with the sodium and bicarbonate ions in the baking soda to give us two new chemicals, carbonic acid and sodium acetate.  NaHCO3  + HC2H3O2  → NaC2H3O2  + H2CO3  (baking soda) (vinegar) (sodium acetate) (carbonic acid)  The second reaction happens because carbonic acid is not very stable and, almost immediately, starts to break down into water and carbon dioxide.  H2CO3  → H2O + CO2  (carbonic acid) (water) (carbon dioxide)  So, the final equation for the reaction between baking soda and vinegar is:  NaHCO3 + HC2H3O2 → NaC2H3O2 + H2O + CO2  It is the carbon dioxide which creates the bubbles and foam you see building up in your bag before it finally explodes.  It is also a physical reaction because there is a change of state. The baking powder (a solid) and the vinegar (a liquid) react chemically to form water (a liquid), carbon dioxide (a gas) and a dilute solution of sodium acetate. (We call this an aqueous solution because it contains water. Discuss other aqueous solutions with your student/s.)  As this is a chemical change though, it is irreversible. We could not get back the original baking soda or vinegar from our experiment. | | |
| **Curriculum links** | | |
| |  |  | | --- | --- | | **England: National Curriculum**   * **Science; lower KS2** * observe that some materials change state. * **Science; upper KS2** * demonstrate that dissolving, mixing and changes of state are reversible changes - explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible. | **Northern Ireland Curriculum**   * **Primary; The world around us** * KS2 changes that occur to everyday substances, for example, when dissolved in water. | | **Scotland: Curriculum for Excellence**   * **Science; Materials – Properties and uses of substances; Second** * By contributing to investigations into familiar changes in substances to produce other substances, I can describe how their characteristics have changed. | **Wales: National Curriculum**   * **Science KS3** use a range of apparatus and equipment safely and with skill, taking action to control the risks to themselves and others | | | |