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| **Activity title** |
| **Wintery window decorations** |
| **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:⚠ |
| **Time required** |
| 30 mins plus overnight to dry |
| **Activity summary** |
| One of the traditions at Christmas time is to decorate our houses. In this fun challenge we are going to get stuck in making wintery window decorations which stick to the windowpane all by themselves! |
| **What equipment will you need?** |
| * Four small bottles of white PVA glue * Green, red, blue, and yellow food colouring (or whatever colours you like) * Washing up liquid * A plastic chopping board or plastic tray * Biodegradable glitter * Four small bowls * A mixing spoon   And have an adult to help. |
| **How to do it** |
| Watch the video here: ADD LINK TO VIDEO  **Step 1**  Pour the whole content of each bottle of PVA glue into the four separate bowls.  **Step 2**  Add some washing up liquid to each dish and stir well. You need to use about two drops of washing up liquid for every two tablespoons of glue. If you want your designs to be solid use a little less – if you want your designs to be transparent use a little more!  **Step 3**  Add a different colour of food colouring to each bowl and stir well. If you want to have white, then leave the food colouring out altogether.  **Step 4**  Pour the coloured glue back into the small bottles and screw on the lids tightly.  **Step 5**  It’s time to get creative! Draw your design onto the plastic chopping board or tray using the different coloured glue bottles. (Top tip! You can even use the plastic pockets that go in Lever Arch Files.) Some ideas of things you could create are holly leaves, snowmen, Christmas trees and snowflakes.  **Step 6**  Leave your creations overnight to dry. In the morning you can peel them off the plastic board and they will be ready to stick to the window!  **Well done – you’ve cracked the Christmas challenge!** |
| **Here’s the science!** |
| Our designs were sticky enough to attach to the window because of the glue we used. But what is it that makes glue, like PVA, sticky? And why are some glues stronger than others?  The function of glue – or **adhesives** - is to hold things together. Adhesives come in many different types – some are runny like the PVA we used in our challenge, others come in the form of sprays, twist up sticks, or sticky tape, like the sort we use to wrap presents. So what’s going on? Well, the stickiness of the adhesive is caused by **molecular bonds**, and its strength depends on how much stress is needed to pull those bonds apart. |
| **Stickiness** |
| All molecules have a **positive** or a **negative** charge and when they meet their opposites they will be drawn together – like the opposite poles on a magnet. Adhesives contain long chains of protein **molecules** which have positive and negative charges that bond with the positive and negatively charged molecules of the surface they are spread upon, by entering the pores and spaces of the material. The stronger the bonds between the molecules the stronger the adhesive will be. |
| **Strength** |
| To test adhesive strength, laboratories try to pull or slide the bonded surfaces apart. Some adhesives are so strong that the things they are sticking together will break before the adhesive breaks! |
| **A sticky history** |
| Before manufactured glues like PVA existed people found ways to make things stick together. This was possible because a number of natural substances similarly create **bonds** with surfaces, although in a number of different ways. These substances range from food stuff such as honey and animal fat, and substances derived from hooves and skin, to beeswax and even egg whites have been used in the past as an adhesive. |
| **Did you know?** |
| Post it notes are handy because they will stick to surfaces but can be repositioned easily. The special adhesive they use, which consists of something called **microspheres** was thought to be too weak to be useful for many years until a scientist called Art Fry had a EUREKA moment! He realised it would be perfect for bookmarking pages without damaging paper – and a stationary classic was born! |