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| **Activity title** |
| **Build a marshmallow catapult at home** |
| **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** |
| 1 hour plus |
| **Activity summary** |
| Through the years the basic catapult structure has been refined many times. Although successful designs were often a closely guarded military secret, we’re happy to share ours with you!  In this activity, you’re going to build a catapult capable of propelling a marshmallow across the room. You can follow our basic design suggestion, or modify it, or come up with your own – the choice is yours.  One of the most important things to bear in mind when making your catapult is that it will need to be strong and stiff, to prevent it from collapsing – launching all those marshmallows will subject it to a range of forces. A few strategically placed triangles should help to reinforce your structure. |
| **What equipment will you need?** |
| **For the marshmallow holder:**   * Marshmallow catapult holder net, printed on card * Scissors * Glue sticks * Marshmallows   **For the catapult structure:**   * Printout of the marshmallow catapult structure design * 6 cube pieces of softwood (8mm x 8mm x 590mm) (l x w x h) * Saw (tenon saw, coping saw or junior hacksaw) * Vice, bench hook or similar item (to secure the wood while you’re sawing it) * Glue gun * Sandpaper (to smooth out any rough edges after you’ve cut the wood) * Pencil * Elastic bands * A4 piece of cardboard (to use as a baseboard when you’re gluing) |
| **How to do it** |
| **Step 1 – Cut and fold the net**   * Cut out the marshmallow holder net, following the bold outline * Fold the net along the dotted lines (the dots should be inside the folds)   **Step 2 – Create the marshmallow holder shape**  SAFETY FIRST   * Always treat the glue gun as if it’s hot * When you’re not using the glue gun, stand it up * Always use a board underneath * Don’t touch anything with the hot end apart from what you’re gluing * Never touch the glue – it may still be hot * Use a glue gun to add glue to the tabs⚠ * Create the holder shape by pressing the glued tabs firmly in place   **Step 3 – Cut out the wood**   * Use a pencil to mark the wood where it needs to be cut (hold the wood against your design printout) * Make sure the wood is held securely in place – use a vice, bench hook or something similar * Use the saw to cut the wooden pieces for your structure – if you can, use angles so that you can reinforce the structure with triangles (see photos on Step 4)⚠   **Step 4 – Stick your catapult structure together**   * Have a good look at the photos on this page (and the cover page) before you start gluing * Use the glue gun to stick the following:⚠   + the bucket onto the launcher   + your catapult structure together * Use elastic bands to create a pivot for the launcher, as shown in the photo examples   **Step 5 – Prepare for launch!**   * Place a piece of A3 paper on the floor (if you don’t have any A3, place two A4 sheets side by side) * Put a marshmallow in the holder (no snacking!) * Fire the marshmallow and note where it lands   **Step 6 – Perfect your launch technique**   * Experiment with the marshmallow’s trajectory * See what happens if you tilt the catapult * Try applying less/more force * Keep going until you can consistently hit the target   We hope you enjoyed catapulting your marshmallows. Why not try launching other small (unbreakable) objects? |
| **Festive fun** |
| After all that hard work, here are some catapult jokes to make you smile:   * **Did you hear about the zookeeper who catapulted a lion into its cage?**   There was an uproar.   * **I entered a paint catapult in a competition.**   I won with flying colours.   * **I was going to write a joke about catapults, but I ran out of time.**   Never mind, it was a long shot. |
| **Did you know?** |
| * Catapults were often positioned on higher ground or castle towers so that objects were propelled across greater distances. * The bodies of plague victims were catapulted over the protective city walls of enemies, to infect the besieged residents – an early form of biological warfare. * Soldiers used catapults in the First World War to fling hand grenades at enemies. |

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| **Bonus activity – fancy taking the marshmallow challenge?** |
| The Marshmallow Challenge is very simple. It’s great fun to take it on in small groups, but you can of course try it out as an individual if you like.  Your challenge is to design and build the tallest structure, using only the materials listed below. The marshmallow must be positioned on top of your structure. You have 18 minutes to complete the task.  Find out more about the challenge [here](https://www.marshmallowchallenge.com/). |
| **Here’s what each group (or individual entrant) will need:** |
| **Here’s what each group (or individual entrant) will need:**   * 20 equally sized strands of dried spaghetti * 1 metre of sticky tape * 1 metre of string * 1 marshmallow |
| **You might think you’re just going to be designing a spaghetti and marshmallow structure, but you’ll also:** |
| * Practise following instructions * Work with a limited range of materials and to a tight deadline * Develop your practical skills, by building a structure * Experience what it’s like to design, make, test and refine a prototype – the creative product development process * Learn to ‘think outside the box’ (if your structure collapses, work out why and devise an alternative solution) * Appreciate the value of prototypes and iterative design when developing a product * Have a lot of fun! |