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| **Vacuum forming project for KS3** | | | |
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| Using vacuum forming to make chocolate egg moulds | | | |
| **Subject(s):** Design & Technology  **Approx time:** 50 - 80 minutes |  | | **Key words / Topics:**   * Casting * Former * Manufacturing processes * Mould * Packaging * Thermoplastics * Vacuum forming |
| **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: ⚠ | | | |
| **Suggested Learning Outcomes** |  | |  |
| * To understand the main stages of the vacuum forming process * To be able to use the vacuum forming process to create a mould for a chocolate Easter egg * To be able to cast a chocolate Easter egg from a vacuum formed mould | | | |
| **Introduction** |  | |  |
| Although chocolate was introduced to Europe in 1502, it was initially just made into drinks, like cocoa. Chocolate Easter eggs were first made in France and Germany in the 19th Century. The first chocolate egg in the UK was made in 1873 by J S Fry and Sons Limited. One of the challenges with making these eggs was to form their shape.  This is one of a set of resources designed to allow learners to use Easter themes to develop their knowledge and skills in Design & Technology, Science and Mathematics. This resource focuses on using the vacuum forming process to create a mould for a chocolate Easter egg.  Please note that this activity requires access to a workshop for vacuum forming and appropriate facilities for hygienic food preparation, such as a food technology room. | | | |
| **Purpose of this activity**  In this activity learners will learn about the vacuum forming process and its applications. They will learn how to use a vacuum forming machine to produce a mould that they can then use to cast a chocolate Easter egg.  This activity could be used as a main lesson activity to teach learners about the use of vacuum forming, or as part of a wider scheme of learning covering either manufacturing processes and techniques or the integration of different disciplines within design & Technology. | | | |
| **Activity** |  | | **Teacher notes** |
| **Introduction (10-15 minutes)**  Teacher to explain that learners are going to make a chocolate Easter egg mould and use it to cast their own egg.  Teacher to introduce and hand out resources required for the task to learners.  **Making the Easter egg mould (30-50 minutes)**  Teacher to demonstrate the steps shown in the presentation and listed below:   * Step 1 – Place the former into the vacuum forming machine. * Step 2 – Place the plastic sheet into the machine and secure in place. * Step 3 – Turn the heater on and wait for the plastic to become soft. Turn the heater off once this happens. * Step 4 – Pull the handle to move the former upwards so that it presses into the soft plastic sheet. * Step 5 – Turn the pump on to remove the air from underneath the plastic. This forms the shape around the former. * Step 6 – Remove the mould from the vacuum forming machine and cut away the waste edges.   Learners to complete each step for themselves. The teacher presentation could be left on the whiteboard as a supporting guide as they do this.  **Casting the Easter egg (10-15 minutes)**  Teacher to demonstrate the steps shown in the presentation and listed below:   * Melt the chocolate using a bain marie. * Pour melted chocolate into the mould and tilt the mould to coat uniformly all over. Remove once set to create a half egg shape. * Repeat and join the two half eggs to create a full chocolate egg.   Learners to complete each step for themselves. The teacher presentation could be left on the whiteboard as a supporting guide as they do this. |  | | **Use of vacuum forming equipment**  In many school workshops there will only be one or two vacuum forming machines available for use. In this instance learners will need to take turns in using this equipment. They could be split into small groups to make this process less time consuming.  **Making the Easter egg mould**  The teacher or technician will need to produce a former for a half egg shape out of suitable material, such as medium density fibreboard (MDF) or polystyrene. This has the advantage of determining the size of the egg or could also allow multiple half eggs to be produced from a single polymer sheet. If additional time is available, learners could design their own formers, making these from, for example, modelling clay. It is essential in this case that the moulds are cleaned thoroughly prior to use.  A suitable polymer material to use for vacuum forming would be food-grade high impact polystyrene (HIP). This can be purchased in a range of sizes and colours.  When heating the plastic sheet wait until it becomes soft and pliable before turning the heater off. The plastic must not be heated for too long, as it will melt. A good way to check if it is ready to be formed is to gently tap the sheet - if it is starting to become flexible or it produces wave-like ripples then the heater can be turned off.  **Casting the Easter egg**  The two half chocolate eggs can be joined by placing them on a warm surface to slightly melt the edges, and then lining them up together. The following video provides useful support for this process. <https://www.youtube.com/watch?v=QMRLgbR1LNE> |
| **Differentiation** |  | |  |
| **Basic** |  | | **Extension** |
| * Chocolate could be melted by the teacher or technician and provided in jugs as measured quantities. * Video tutorials could be produced and used as extra support for lower ability learners when using the vacuum forming machine. These could be linked to and accessed via tablet computers or the student’s own devices, if available, using a QR code sticker placed on the machine itself. The videos could be produced by the teacher, technician or other learners. |  | | * Learners could make their own formers in modelling clay or MDF. * Learners could use what they have learnt about vacuum forming to create a blister package for their chocolate Easter Egg. |
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| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * Half egg-shaped former * Suitable material for forming, such as high impact polystyrene (HIP) * Vacuum forming machine * Stanley knife or other cutting tool suitable for trimming the edges of the formed plastic mould * Chocolate for melting (either cooking chocolate or milk chocolate bars work well) |  | | icon-ppt Teacher presentation – Vacuum forming project for KS3 |
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| **Additional websites** |  | |  |
| * **BBC Bitesize Class Clips –** Vacuum forming: Video explaining the vacuum forming process. <https://www.bbc.co.uk/teach/class-clips-video/design-and-technology-ks3-explain-this-vacuum-forming/zj926v4> * **YouTube – Assembling hollow figures:** Video demonstrating how two hollow chocolate eggs can be easily joined together. <https://www.youtube.com/watch?v=QMRLgbR1LNE> | | | |
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| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)   * Discuss the importance of following safety procedures when using tools and equipment. * Hand out a picture of a vacuum forming machine and ask learners to label the main parts. | | **Extension** (Options)   * Learners could make their own formers in modelling clay or MDF. * Learners could create a blister package for their chocolate Easter Egg.   **Plenary**   * Discuss the advantages and disadvantages of using the vacuum forming process to produce plastic moulds for casting. | |
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| **The Engineering Context** film |
| * Engineers use vacuum forming for manufacturing a wide range of products, such as storage containers, children’s toys, baths and food packaging. |

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| **Curriculum links** | |
| **England: National Curriculum**  Design & Technology   * KS3 2a   **GCSE D&T**  AQA D&T   * 3.2.8, 3.3.10, 3.3.11   Edexcel D&T   * 4.6.3e, 4.7.2f   Eduqas D&T   * Thermosetting and thermoforming plastics: 6   OCR D&T   * 7.2aiii | **Northern Ireland Curriculum**  Technology & Design   * KS3 Knowledge, understanding and skills: Manufacturing – selecting and using materials fit for purpose; safe use of a range of tools and processes appropriate to materials, demonstrating accuracy and quality of outcome. |
| **Scotland: Curriculum for Excellence**  Technologies   * TCH 3-09a, TCH 3-12a | **Wales: National Curriculum**  Design and Technology   * KS3 Skills: Making 1, 2 |
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| **Assessment opportunities** | | |
| * Informal teacher assessment of practical skills through observation of learners. * Formal teacher assessment of completed eggs. | | |
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