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| **Rubber Band Helicopter** |
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| A thrilling project to make a flying rubber band powered helicopter |
| **Subject(s):** Design & Technology, Mathematics, Science**Approx. time:** 60 - 90 minutes  |  | **Key words / Topics:** * Helicopter
* Propeller
* Airbrake
* Anti-clockwise
* Flight
* Linkage
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| **Suggested Learning Outcomes**  |  |  |
| * To understand how to use a linkage to create movement
* To be able to make and assemble a rubber band powered helicopter
* To be able to test fly the helicopter
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| **Introduction** |  |  |
| This is one of a set of resources designed to allow learners to use seasonal themes to support the delivery of key topics within design & technology, maths and science. This resource is part of a group for the Summer that could be carried out either in school or at home. It is based on making a rubber band powered helicopter and carrying out flight tests.This activity introduces the concept of flight, simple mechanisms, and energy through the making of a rubber band powered helicopter. This is a complicated activity requiring some manual dexterity, targeted at the upper end of Key Stage 2. |
| **Purpose of this activity**In this activity learners will build a working rubber band powered helicopter. They will learn about simple mechanisms using a rubber band linkage and will know how to wind up the rubber band to create stored energy, which the helicopter will use to fly.This activity could be used as a main lesson activity, to teach learners about the factors that affect flight. It could also be used to develop practical skills in design & technology, introduce simple mechanisms, or to start a discussion on different forms of energy.  |
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| **Activity** |  | **Teacher notes** |
| **Introduction (5 minutes)**Teacher to explain that learners are going to make a flying rubber band powered helicopter.**Demonstration: making the rubber band powered helicopter** **(20-30 minutes)**Teacher to demonstrate the steps shown in the teacher presentation and listed below:* Step 1 – Make the tube by rolling the card template around a pencil and securing with sticky tape.
* Step 2 – Carefully use scissors to cut out the propeller by wrapping the template around a card tube. Use a sharp pencil and an eraser to make a hole in the centre of the propeller.
* Step 3 – Straighten a paper clip and use pliers to cut it to the size of the template. Bend the wire following the template then make a hook using the pliers.
* Step 4 – Straighten out a paperclip and bend following the W template, then use pliers to cut off the ends.
* Step 5 – Glue the disc template to a yoghurt pot top and carefully cut it out with scissors. Carefully use a sharp point to make a hole then enlarge the hole with a skewer.
* Step 6 – Attach the plastic disc to the wire hook then attach the bead. Bend the wire to keep the bead in position.
* Step 7 – Feed the hook through the centre hole of the propeller then bend the wire with pliers. Cut off the wire leaving 5 mm to bend over the propeller and secure it in place.
* Step 8 – Put the rubber band onto the W wire and use a long hook, pushed through the tube, to pull the rubber band through. The W wire sits at the bottom of the tube.
* Step 9 – Connect the propeller hook on the top of the rubber band. Measure 30 mm from the top of the tube and use sticky tape to attach the airbrake.

**Performing the Activity (30-45 mins)**Teacher to hand out equipment and worksheet. Learners to carry out the activity.Learners to test the helicopter as shown in step 10. Hold the helicopter and wind up the propeller in an anti-clockwise direction. It may need about 50 turns dependent on the type of rubber bands used. Hold the helicopter vertical and let go of the propeller and watch it fly. Keep a record of what heights and flight patterns the helicopters achieve.**Plenary (5-10 minutes)**Learners to share their experiences about building and flying the rubber band helicopter. What went well during the build? What could be improved? How well did the helicopter fly?  |  | **Rubber band powered helicopter activity**Print the activity sheet onto thin card. Carefully cut out each part of the activity sheet. Step 1 – Make sure the full length of the tube is covered in sticky tape to strengthen it.Step 2 – You should be able to get at least 6 propellers from one card tube. With either an eraser or sticky tack behind the propeller, push through the tip of a sharp pencil to make the hole.Steps 3 to 7 – Use longnose pliers, if available, to cut and bend the paper clips. Some learners may need assistance with this task.Step 8 – Use a crochet hook, wire or similar to hook and thread the rubber band through the tube. To prevent the W wire from catching put some sticky tape over the ends. Of the tube before the W is positioned.Step 9 – To prevent the rubber band from snapping back into the tube, use a skewer or paper clip to hold the rubber band in place whilst attaching the hook.Step 10 – When winding up the helicopter, the number of turns will depend upon the type of rubber bands used. You may wish to experiment to see which ones work best. When testing the rubber band helicopters, learners should release them in a safe zone to ensure that, if the helicopter flies sideways, no one will get hit. The helicopter should fly at least one metre into the air. It is recommended to carry out flight tests in an environment with suitable height, such as the school hall or (wind permitting) in the playground. |
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| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| * Provide learners with shaped wires, rather than paper clips.
* Provide learners with pre-cut parts (paper and/or plastic disc).
* Support may be required to pull the rubber band through the tube.
 |  | * Learners may adapt and experiment on their helicopter design.

What happens if:* the airbrake is removed, or its size and position changed
* the number of rubber bands is changed
* the length of the tube is changed
* Watch **YouTube**: How does a helicopter work: https://www.youtube.com/watch?v=YJBhWVDArLo
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| **Resources** |  | icon-ppt**Required files** icon-docicon-pdf |
| * Printed activity sheets
* Paperclips (30mm)
* 1 bead per pupil (6 to 8 mm)
* Sticky tape
* Pliers (longnose type are best)
* Rubber bands
* Yoghurt pot tops or other thin plastic
* Small card tubes
* Erasers or sticky tack
* Skewers
* Wire/crochet needle/ thread/fishing line to pull rubber band through the tube.
 |  |  Teacher presentation – Rubber band helicoptericon-doc Rubber band helicopter activity sheet |
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| **Additional websites** |  |  |
| * **BBC Bitesize:** Who helped flight take off? https://www.bbc.co.uk/bitesize/topics/zvb76v4/articles/zdcskmn https://www.youtube.com/watch?v=eBIS17Va9sA
* **YouTube**: How does a helicopter work: https://www.youtube.com/watch?v=YJBhWVDArLo
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| **Related activities (to build a full lesson)** |  |  |
| **Starters** (Options) To introduce the activity about flight* Watch **BBC Bitesize:** Who helped flight take off? https://www.bbc.co.uk/bitesize/topics/zvb76v4/articles/zdcskmn https://www.youtube.com/watch?v=eBIS17Va9sA
* Ask learners: what is special about a helicopter compared to an aeroplane? How many blades do helicopters have?
 | **Extension** (Options) * Learners to experiment on the helicopter: What happens if the airbrake is removed? What happen if you change the size and position of the airbrake? What happens if change the number of rubber bands? What happens if you change the length of the tube?
* Watch **YouTube**: How does a helicopter work: https://www.youtube.com/watch?v=YJBhWVDArLo

**Plenary**Learners to share their experiences about building and flying the rubber band helicopter. What went well during the build? What could be improved? How well did the helicopter fly? |
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| **The Engineering Context** film |
| * Helicopter engineers are responsible for the maintenance and repair of helicopters. They work around the world looking after helicopters used by the military, emergency services, transport and for private use.
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| **Curriculum links**  |
| **England: National Curriculum**MathematicsScienceKS2 - Forces* effects of levers, pulleys, and simple machines on movement.
 | **Northern Ireland Curriculum**KS2 – The World Around usMovement and energy* changes in movement
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| **Scotland: Curriculum for Excellence**Numeracy and MathematicsShape, position and movementMTH 2-16b * show understanding of the relationship between 3D objects and their nets.
 | **Wales: National Curriculum** KS2 – Science How things work* the ways in which forces can affect movement and how forces can be compared
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| **Assessment opportunities** |
| * Informal formative assessment of the making and testing and responses to questions during the plenary.
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