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| **Measure time with a water clock** | | |
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| How to make a water clock that measures time | | |
| **Subject(s):** Design and Technology, Maths, Science, History  **Approx time:** 40-60 minutes |  | **Key words / Topics:**   * Ancient Greece * Accuracy * Millilitres * Consistency * Duration * Time * Seconds * Water |
| **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 how time can be measured using water. * To be able measure a set time period and to experiment with variables. | | |
| **Introduction** |  |  |
| This is one of a set of resources designed to allow learners to use practical methods to support the delivery of key topics within the national curriculum. This resource is based on making a water clock that helps time a set duration/period.  This activity is inspired by the achievements of ancient Greece and how these have affected the modern world. It shows the learners how to make an accurate timing device using simple objects and challenges learners to explore the variables which effect the amount of time measured | | |
| **Purpose of this activity**  In this activity learners will discover how to create a practical aid to measure time. They will learn practical skills in accurate model making and measurement.  This activity could be used as a main lesson activity, to introduce time and associated calculations or to teach learners about how the ancient Greeks have affected life in the modern world. It could also be extended to introduce experimental practices in science. | | |
| **Activity** |  | **Teacher notes** |
| **Introduction (5 minutes)**  Teacher to introduce the activity, using principles from ancient Greece to measure time.  **Making holes (10-15 minutes)**  Teacher to demonstrate how to safely make holes in the paper cup and the plastic cap.  Put the modelling clay on the outside of the object and press the pencil through the object into the clay. Use a sharp pencil to make **small** holes in the bottom of the paper cup and the plastic cap.  Learners make holes in their paper cups and plastic caps.  **Make your water clock (10-15 minutes)**  Teacher demonstrates how to thread the plastic cap onto string tying a knot, then to attach the bell with another knot.  Learners work in pairs to assist each other joining together the bell and cap.  **Getting ready to use your water clock and using your water clock (15-25 minutes)**  Teacher demonstrates how to set the clock up ready for testing.   * Balance the cup over the collection bowl. * Carefully balance the bell on one of the craft sticks. * Measure the correct amount of fluid (100ml). * Pour in the water to the cup – be careful not to pour it into the plastic cap. * Immediately start a stopwatch. * Time how long it takes before the bell falls into the cup.   Learners to set up their clocks and repeat the measurement at least three times, then calculate the average time taken. |  | Whilst each individual can make their own clock, the use of the clock and experimentation in this activity is more straightforward if carried out by learners working in pairs. Access to water and a wet area is needed for the experimentation.  **Making holes**  This should be carried out in conformance with the school’s risk assessment for the making of holes using a sharp object.  The hole in the plastic cap needs to be just large enough for the string to push through. The larger the hole in the paper cup, the shorter the time period that will be measured by the clock.  **Make your water clock**  A bradawl or similar could be used to push the string through the hole in the plastic cap.  **Getting ready to use your water clock**  Learners can be assisted if they are provided with a pre-prepared frame of craft sticks, glued together.  When timing, one learner could pour the water whilst the other operates the stopwatch.  Repeating the measurement three times should show how consistent and accurate the clock is. |
| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| * Provide learners with pre-holed/drilled components to ease making. * Allow learners to use hot glue to secure the bell and bottle cap instead of tying a knot. |  | What happens if you:   * Increase the quantity of water? * Make the hole in the cup bigger? * Make the length of string shorter or longer? |
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| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * Cardboard/paper cup. * Pencil and pens. * String. * Scissors. * Measuring jug. * Modelling clay. * Water. * Craft (lollipop) sticks. * Plastic bottle top. * Small bell. |  | | icon-ppt Measure time with a water presentation |
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| **Additional websites** |  | |  |
| * **Estimating time:** <https://www.youtube.com/watch?v=acuX0-g08rY> * **Estimated time recorded maths lesson**: <https://www.youtube.com/watch?v=LJPe6y0ToMU> * **A brief history of (keeping) time:** <https://www.youtube.com/watch?v=mjSwRwAqQA4> | | | |
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| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)  Estimate the time taken for a selected activity – walking the length of the classroom/playground. How could we measure this without a watch, clock or phone? | | **Extension** (Options)  What happens if you:   * + Increase the quantity of water?   + Make the hole in the cup bigger?   + Make the length of string shorter or longer?   **Plenary**  Learners to share their timing results and discuss how this could be altered by adjusting quantities, changing the size of the hole or adjusting the length of the string. | |
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| **The engineering context** film |
| Timing activities effect all areas of engineering. Timing helps to ensure that activities are carried out in the correct sequence. Knowing how long an activity takes means you can work out how much the labour to complete it costs, which contributes to how much customers will have to pay for the activity or manufactured item. |

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| **Curriculum links** | |
| **England: National Curriculum**  D&T KS2   * Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities. | **Northern Ireland Curriculum**  Maths KS2   * Use mathematics to solve problems and make decisions. |
| **Scotland: Curriculum for Excellence**  Mathematics   * I have worked with others to explore,  and present our findings on how mathematics impacts the world and the important part it has played  in advances and inventions. * MTH 2-12a. | **Wales: National Curriculum**  D&T KS2   * Measure, mark out, cut, shape, join, weigh and mix a range of materials and ingredients, using appropriate tools/utensils, equipment and techniques. |
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| **Assessment opportunities** | | |
| Summative assessment of the finished clocks.  Informal formative assessment of the discussion about the factors affecting the measured time. | | |
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