|  |  |  |
| --- | --- | --- |
| **Air powered cars** | | |
|  |  |  |
| Using air power to race cars! | | |
| **Subject(s):** Design & Technology, Maths, Science  **Approx. time:** 40 – 60 minutes |  | **Key words / Topics:**   * Air * Car * Balloon * Pneumatic * Speed * Time |
| **Suggested Learning Outcomes** |  |  |
| * To be able to build a moving car using plastic construction blocks * To be able to accurately measure the time taken by an activity * To be able to carry out a simple calculation of speed | | |
| **Introduction** |  |  |
| This is one of a set of resources designed to allow learners to use summer themes to develop their knowledge and skills in Design & Technology, Engineering, Science and Mathematics. This resource is part of a group for the Summer that could be carried out either in school or at home. It involves building balloon powered cars from plastic construction blocks. | | |
| **Purpose of this activity**  In this activity learners will make cars from plastic construction blocks, for example Lego®. They will use balloons to power these vehicles and measure their speed over a set distance.  This activity could be used as a main lesson activity, to introduce learners to forces that cause movement or pneumatics. It could be linked with the IET Cardboard car activity, which would facilitate expanding the programme of work to cover other forms of device that can cause movement. It could also be used as a short introduction to building using plastic construction blocks, as a precursor to introducing the Frist Lego League. | | |
|  |  |  |
| **Activity** |  | **Teacher notes** |
| **Introduction (5-10 minutes)**  Teacher to explain that learners are going to make and race balloon powered cars from plastic construction bricks.  **Making the car (20 - 30 minutes)**  Teacher to demonstrate the steps shown in the teacher presentation and listed below, then learners to carry out the activity:   * Step 1 – build the balloon holder. The space in the middle needs to be large enough to allow the end of the balloon to fit through, but small enough to trap the ‘ring’ at the end of the balloon so that it does not fly out! * Step 2 – Build the base. Position the balloon holder at the back of the base - it helps to raise up the balloon holder slightly, to give more space for the balloon * Step 3 – Race/Testing. Measure the time it takes for the car to travel a set distance.   **Review (5-10 minutes)**  Class discussion – which of the cars were fastest? Why? |  | This activity could be carried out individually; however, the speed measurement should ideally be carried out in pairs or small groups.  **Making the car**  Learners could be encouraged to have as many wheels as they desire (3, 4, 6, 8 have all been used effectively) and could add any additional features they wish for creativity (although these will slow the vehicle down).  Hand operated balloon pumps could be provided if inflation is an issue. To assist in fitting through the gap in the balloon holder and inflating the balloon when in place, a plastic straw could be inserted into the outlet from the balloon and secured (to ensure no leaks) with strong sticky tape wrapped around multiple times. A clip on the straw should prevent the balloon deflating until required.  **Testing**  Learners may need guidance in how to use a stopwatch if they have not used one previously. If working in pairs, one should control the stopwatch and the other start the release of air.  It is recommended to pre-measure a test ‘course’ of 2 m to 5 m in length. The use of card walls or ‘crash barriers’ can assist in supporting vehicles to reach a marked finish line. An effective way of marking the start and finish line is a strip of masking tape on the floor.  Learners could create a table of results as shown on slide 6.  To convert a speed in meters per second to miles per hour, multiply it by 2.24 – this could then be compared to the speed of other vehicles.  **Review**  Examples for comparison (all figures are approximate):   * The land speed record set by Thrust SSC is 763 mph * Airliners typically travel at approximately 560 mph * The record for a radio-controlled car is 200 mph. * High speed trains can reach speeds of 190-220 mph * The speed limits for cars are 20, 30, 40, 60 or 70 mph * The world record for the 100 m is just over 23 mph * The average speed of a top long-distance runner is about 6 mph * The average speed of a walking person is 3-4 mph * Snails can travel at speeds of up to 1 mph! |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| * Provide inflated balloons with clips to seal the ends until release is required. * Provide exemplars that learners could copy. |  | * Learners could investigate the speed of other vehicles and compare those values to the speed of their cars. * Learners could try making different designs of car, to see which is fastest and why. * Learners could try using different sizes of balloon, to see if they change how fast the car is. |
|  |  |  |
| **Resources** |  | **Required files** icon-docicon-pdficon-ppt |
| * Plastic construction bricks, including wheels * Balloons * A stopwatch or a stopwatch App on a phone * If available: a tape measure to measure the distance of the course * Optional: plastic straws, sticky tape, cardboard strips (for walls for the test track) |  | icon-ppt Teacher presentation – Air powered cars |
|  |  |  |
| **Additional websites** |  |  |
| * **YouTube** – making a balloon powered car from plastic construction blocks: <https://www.youtube.com/watch?v=PF4_xMovgG0>**;** alternative example presented by children, including racing <https://www.youtube.com/watch?v=XRkFAz_LQi8> * **Examples of other people’s balloon-powered cars made from plastic construction blocks:** <https://frugalfun4boys.com/lego-fun-friday-balloon-powered-car-building-challenge/> and <https://littlebinsbricks.com/lego-balloon-car/> * **Calculating speed**: video explaining how speed is calculated – aimed at Key Stage ¾, but simple language used <https://www.youtube.com/watch?v=_nAKwhZyXnw> * **Lego engineering** – ideas and inspiration for activities with plastic construction bricks: http://www.legoengineering.com/ * **Lego cars** – an educational project to design and make an electrically powered car: <https://education.lego.com/en-gb/lessons/wedo-2-science/speed> * **Examples of vehicles made using a plastic construction brick set** - <https://www.tts-group.co.uk/lego-vehicles-set-934pcs/1000699.html?cgid=Brands-LEGO> * **First Lego league** – in the UK <https://education.theiet.org/first-lego-league-programmes/> and internationally <https://www.firstlegoleague.org/> | | |
|  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)   * Show the video: **YouTube** – making balloon powered cars: <https://www.youtube.com/watch?v=PF4_xMovgG0> or <https://www.youtube.com/watch?v=XRkFAz_LQi8> | | **Extension** (Options)   * Learners could investigate the speed of other vehicles and compare those values to the speed of their cars. * Learners could try making different designs of car, to see which is fastest and why. * Learners could try using different sizes of balloon, to see if they change how fast the car is.   **Plenary**   * Peer review – which cars were fastest? Why? | |
|  |  | |  |

|  |
| --- |
| **The Engineering Context** film |
| Using the force of gas being expelled from a vehicle to move it is the method used by space rockets and jet engines.  Calculating the speed is used for almost all powered vehicles, from family cars to formula 1 racers to space rockets. |

|  |  |  |
| --- | --- | --- |
|  |  |  |

|  |  |
| --- | --- |
| **Curriculum links** | |
| **England: National Curriculum**  Design and Technology  KS2 Make:   * select from and use a wider range of tools and equipment to perform practical tasks; * 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   Science  KS2 Working scientifically:   * taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate   Mathematics Key Stage 1 Year 2  Number – multiplication and division   * solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.   Measurement   * compare and sequence intervals of time | **Northern Ireland Curriculum**  The World Around Us   * Movement and energy: The causes and effect of energy, forces and movement   Mathematics and Numeracy Key Stage 1  Number / operations and their applications   * understand the operations of addition, subtraction, multiplication and division (without remainders) and use them to solve problems   Measures   * understand and use the language associated with length, weight, capacity, area and time   Handling data / Collecting, Representing and Interpreting Data   * collect data, record and present it using real objects, drawings, tables, mapping diagrams, simple graphs and ICT software; * discuss and interpret the data. |
| **Scotland: Curriculum for Excellence**  Technologies   * TCH 2-09a, TCH 2-10a, TCH2-12a,   Sciences   * SCN 2-07a   Mathematics  Number and number processes   * MNU 2-03a, MNU 2-03b.   Measurement   * MNU 2-10b, MNU 2-11b | **Wales: National Curriculum**  Design and Technology   * KS2 Making: 1, 2, 3, 4, 6 * KS2 Rigid and flexible materials: 10, 12 * KS2 Systems and control: 13 * KS2 Health and Safety   Science:   * KS2 Skills: 3 * KS2 Planning: 2, 4, 5, 6, 7 * KS2 Developing: 2, 3, 4 * KS2 How things work: 2, 3   Mathematics Programme of Study Key Stage 2  Developing Numerical Reasoning   * Identify processes and connections / transfer mathematical skills to a variety of contexts and everyday situations   Using Measuring skills / Time:   * carry out practical activities involving timed events; * time events in minutes and seconds, and order the results (Y5) |
|  |  |

|  |  |  |
| --- | --- | --- |
| **Assessment opportunities** | | |
| * Informal teacher assessment of the practical activity and calculated times. | | |
|  |  |  |