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| **Design a jetpack for playing football on the moon** | | | |
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| Consider how a jetpack works and sketch an idea for a wearable jetpack | | | |
| **Subject(s):** Design and Technology, Engineering, Science  **Approx time:** 50-80 minutes |  | | **Key words / Topics:**   * aerodynamics * design brief * football * gravity * jetpack * moon * sketching * thrust |
| **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 be able to design a wearable jetpack for a game of football on the Moon * To know the different parts of a jetpack * To understand how jetpacks function and the technology needed to make them work | | | |
| **Introduction** |  | |  |
| This is one of a series of resources that are designed to allow learners to use the theme of football on the moon to develop their knowledge and skills in Science, Design & Technology and Engineering. This resource focusses on learners designing a jetpack that the players or referee can use during a game of football on the moon. | | | |
| **Purpose of this activity**  In this activity learners will make use of the theme of football on the moon to design a jetpack that can be worn by either the players or referee during a moon football game. They will consider how a jetpack works and the different parts of a jetpack. They will then sketch an idea for a wearable jetpack for use during the game.  This activity could be used as a main lesson activity to teach about producing initial design ideas for products and systems. It could also be used as part of wider scheme of learning focussed on the engineering challenges associated with living on the moon. | | | |
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| **Activity** |  | | **Teacher notes** |
| **Introduction (5-10 minutes)**  Teacher to introduce the theme of playing football on the moon and the challenges that would be faced when doing this.  **Starter (5-10 minutes)**  Learners to identify the main parts that make up a jetpack. Presentation slides 4 and 5 to be used as prompts.  **How jetpacks work (10 minutes)**  Teacher to then use slides 6 and 7 to explain how a jetpack works and discuss how they have been previously used in space missions.  Explain that the idea of a jetpack has been around for over 100 years. As technology has advanced it has meant they have become a more viable idea. It was in the 1940’s that it was further developed by the US army.  **Design brief (10-20 minutes)**  Teacher to explain the task to learners and introduce the design brief on slide 8 of the presentation.  Teacher to outline the main requirements for the jetpack design.  **Sketching design idea (20-30 minutes)**  Learners sketch and label a design idea for a jetpack that can be worn by either the players or the referee during a game of football on the moon. The example shown on slides 10 and 11 of the presentation can be used to help if needed. |  | | **Introduction**  Slide 3 of the presentation could be used to introduce the theme of football on the moon.  **Starter**  Discuss with learners what parts are needed to for a jetpack to work.  Presentation slide 4 could also be printed and labelled by learners. Example answers are shown on slide 5.  **How jetpacks work**  There is an opportunity to set a homework task where students research and create a timeline of the jetpack.  Slide 6 gives extra information that could be shared with higher ability learners.  **Design brief**  Explain the brief and discuss with learners.  Footballers – think about how they move.  Discuss how the jet pack must fit, the weight of the pack, how it can be wearable, materials it could be made from. Could a logo or team be added, could it be personalised?  **Designing**  Consider the different factors that could affect the design. Discuss with students how footballers and match officials might move, materials to make the jetpack lightweight and how the user might wear it.  **Handout**  Learners could use these sheets as a set of templates to draw their ideas around.  **Example**  An example to assist learners is shown on slides 10 and 11 of the presentation. |
| **Differentiation** |  | |  |
| **Basic** |  | | **Extension** |
| * Provide sentence starters for annotations/labelling of sketches. * Provide templates for learners to draw around, such as images of the referee and players. |  | | * Make a life size model of the jetpack. * Design a spacesuit to be worn by the players and/or referee |
| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * Pens or pencils * Coloured pencils * Rulers |  | | Teacher presentation – Jetpack on the Moon  icon-pdf Handout – Jetpack on the Moon worksheet |
| **Additional websites** |  | |  |
| * **Natural History Museum – Facts about the Moon:** <https://www.nhm.ac.uk/discover/factfile-the-moon.html> * **YouTube – If the football World Cup was on the moon:** <https://www.youtube.com/watch?v=o5tD7eP8izE> * **YouTube - Two astronauts play football on the moon:** <https://www.youtube.com/watch?v=z3Lt0PRt0Dk> * **BBC News article - Jet suit paramedic tested in the Lake District 'could save lives':** <https://www.bbc.co.uk/news/uk-england-54331994> * **NASA Earth’s Moon – Overview:** Earth's Moon – NASA Solar System Exploration <https://solarsystem.nasa.gov/moons/earths-moon/overview/> * **NASA Space Walk YouTube - Spacewalk with NASA Astronaut Steve Bowen and UAE Astronaut Sultan Alneyadi** <https://www.youtube.com/watch?v=ZTvggR94UnA> | | | |
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| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)   * Watch the video – if the football World Cup was on the Moon <https://www.youtube.com/watch?v=o5tD7eP8izE> * Label the different parts of a jetpack and explain how they work. * List possible applications of jetpacks. | | **Plenary**   * Evaluate each design against the design brief, listing improvements that could be made. * Discuss what the future of jetpacks might be. Where can jetpack technology take us? | |
| **The Engineering Context** film | | | |
| * Travelling and potentially living on the moon presents all sorts of challenges for engineers to overcome. For example, how will we breathe, how will we cope with much lower gravity, how will we play sports and keep fit? | | | |

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| **Curriculum links** | |
| **England: National Curriculum**  Design & Technology   * KS3 1a, 1b 1d, 1e   **Science - Physics**   * Fuels and energy resources. fuels and energy resources * Forces as pushes or pulls, arising from the interaction between two objects. | **Northern Ireland Curriculum**  Technology & Design   * KS3 Design – identifying problems; investigating, generating, developing, modelling and evaluating design proposals; giving consideration to form, function and safety * Communication – use of free-hand sketching and formal drawing techniques and ICT tools (including 3D modelling) * 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 3-10a, 4-10a * TCH 3-11a, 4-11a * TCH 3-12a, TCH 4-12a | **Wales: National Curriculum**  Design and Technology   * KS3 Designing: 1, 2, 3, 6, 8 |

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| **Assessment opportunities** |
| * Formal teacher assessment of completed design sketches. * Self/peer assessment of completed design sketches. |