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| **Prosthetic devices** | | | |
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| Generate ideas for future prosthetic devices | | | |
| **Subject(s):** Science, Design & Technology  **Approx. time:** 15 mins |  | | **Key words / Topics:**   * bionics * prosthetics * smart materials * applications & implications of science |
| **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: ⚠ | | | |
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| **Suggested Learning Outcomes** |  | |  |
| * Have an understanding of the links between modern technology and health * Understand that new materials are part of this technology | | | |
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| **Introduction** |  | |  |
| The development of new materials with incredible properties is changing the way we live. From LCD TVs to super light airliners, these materials have quickly found their way into pretty much all of the modern technology around us.  One area where modern materials have made a huge impact is in the development of prosthetic devices. Some of these devices are beginning to outperform ‘natural’ body parts.  The resources within this, and the related activities, encourage students to investigate the properties of smart materials and carry out some data manipulation. Students will also explore the possible moral and ethical issues associated with people potentially choosing to replace healthy body parts with artificial prostheses because they offer higher performance.  **Purpose of this activity**  Using the short video ‘Bionic Limbs’, this activity is a quick, engaging introduction to a lesson looking at the properties of modern materials.  It encourages students to think about how technology is changing our society. | | | |
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| **Activity** |  | | **Teacher notes** |
| **1.** Start with a quick discussion, drawing on students’ film and science fiction knowledge.  What are bionic people?  Have students heard of them before? Where? (TV series ‘The Bionic Woman’).  Is this all science fiction?  Show the short video *Bionic Limbs*.  **2.** Split the class into small groups and give them a few minutes to come up with an idea for a prosthetic device they think they might see in the future, such as a fully working hand that can perform the same functions as a human hand.  *(ca three minutes)*  **3.** Ask each team to report back to the rest of the class. Note down the main points of their ideas on the whiteboard.  End with a short discussion on which of the ideas would be most useful. *(ca five minutes)* |  | | film **Bionic Limbs** Film  We might not be bionic yet, but we are getting close.  Guide the discussion onto the subject of prosthetic devices.  Explain what a prosthetic device is (artificial substitute for a missing body part, such as an arm, leg, eye; used for functional or cosmetic reasons or both) and that engineers are responsible for their development. *(ca 10 minutes)* |
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| **Differentiation** |  | |  |
| **Basic** |  | | **Extension** |
| Give each team a poster made of images of different prosthesis to act as a start to the discussion. Students could be further supported by being given questions/statements to help structure their discussion. Ask each team to focus on a particular area of the body. |  | | Students can research the types of materials they would propose putting into their idea for future prosthesis, giving reasons why they would choose these materials.  Extend the discussion by talking about whether the students think there might come a time when people choose to have body parts replaced because the artificial ones are superior. |
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| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * Access to computer or interactive whiteboard and audio equipment to show the film |  | |  |
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| **Additional websites** |  | |  |
| * Public Broadcasting Service (PBS): The PBS has some useful teacher reference material within their [NOVA](https://www.pbs.org/wgbh/nova/) sites, including an [annotated diagram of a human body](http://www.pbs.org/wgbh/nova/eheart/manmade.html) with various prostheses in place ([www.pbs.org/wgbh/nova/eheart/manmade.html](http://www.pbs.org/wgbh/nova/eheart/manmade.html)). * Professor Kevin Warwick, University of Reading ([www.kevinwarwick.com](http://www.kevinwarwick.com)): Professor has implanted several computer chip devices in his left arm which allow him to interface directly with a range of equipment. * Daily Mail Online: An article about Paralympic T44 100metres champion Johnny Peacock, an amputee who uses a prosthetic leg to help him compete (<http://www.dailymail.co.uk/sport/othersports/article-2327184/Jonnie-Peacock-changes-blades-hopes-avoid-row--Laura-Williamson.html>). | | | |
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| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)   * FILM: Bionic Limbs * FILM: Nature Reinvented * FILM: Prosthetic Design * ACTIVITY: Engineering prosthetics * ACTIVITY: **Prosthetic devices**   **Main** (Options)   * ACTIVITY: Prosthetic replacements * ACTIVITY: Smart Materials 1 * ACTIVITY: Smart Materials 2 | | **Extension** (Options)   * ACTIVITY: Materials for prosthetics * ACTIVITY: Materials for prosthetics 2   **Plenary**   * GAME: Bionic Games * QUIZ: Nature Reinvented * Opportunities within activity for presentations, peer/self assessment * Reflection on Objectives and PLTS skills used | |

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| **The Engineering Context** film |
| * **The story** Bionic Limbs |

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| **Curriculum links** | |
| **England: National Curriculum**  Science   * KS3 6a, 6b * KS4 1.4a,b, 2.1e   Design & Technology   * KS3 1d, 1e, 3b, 3d   GCSE  AQA Design and Technology   * 3.1.1 / Society   Edexcel Design and Technology   * 2.1b, 2.3a   Eduqas Design and Technology   * 12. Designing and making principles Develop and apply core knowledge, understanding and skills:   4. Investigate factors, such as environmental, social and economic challenges, in order to identify opportunities and constraints that influence the processes of designing and making.  OCR Design and Technology   * 2.2a, 3.1a, 5.2c   AQA Engineering  3.5 | **Northern Ireland Curriculum**  Science  Developing pupils’ Knowledge, Understanding and Skills   * develop creative and critical thinking in their approach to solving scientific problems * Chemical and material behaviour; Structures, properties, uses of materials.   (Objective 1) Developing pupils as Individuals   * mutual understanding.   (Objective 2) Developing pupils as Contributors to Society   * explore some ethical dilemmas arising from scientific developments.   Technology and Design  Developing pupils’ Knowledge, Understanding and Skills   * design – identifying problems; investigating, generating, developing, modelling and evaluating design proposals; giving consideration to form, function and safety   (Objective 2) Developing pupils as Contributors to Society   * design cost effective and appropriate solutions to meet the specific needs of diverse local and global groups * Ethical awareness   Learning Outcomes   * demonstrate creativity and initiative when developing ideas and following them through; * work effectively with others; * communicate effectively in oral, visual (including graphic), written, mathematical and ICT formats showing clear awareness of audience and purpose. |
| **Scotland: Curriculum for Excellence**  Sciences   * SCN 4-16a, SCN 4-20a   Technologies   * TCH 3-01a, TCH 2-12a / 3-12a | **Wales: National Curriculum**  Science   * KS3 Range (Interdependence of organisms 7) * KS4 Range (Chemical and material behaviour 4)   Design & Technology   * KS3 Skills (Designing 1, 2) |
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| **Assessment opportunities** | | |
| Students could prepare their own specification for their prosthetic body part, using their group work as inspiration. Their work should be annotated to include choice of material, maybe even samples of the material. Students should then list of the properties of that material and go on to explain why it is a suitable choice for a particular component in their prosthetic body part. This written work could then be used for APP assessment. | | |
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| **Personal, learning & thinking skills (PLTS)** | | |
| * Creative Thinker * Team Worker | | |