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| **Design a Royal carriage** |
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| Designing a new Royal carriage that is electrically powered |
| **Subject(s):** Design and Technology, Engineering**Approx time:** 35-55 minutes (45-75 minutes with optional solar power battery activity) |  | **Key words / Topics:** * batteries
* components
* design brief and criteria
* king’s coronation
* motors
* renewable energy
* solar power
* wiring diagram
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| **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 an electrically powered royal carriage for the King’s coronation
* To understand the benefits of solar energy
* To be able to produce designs to meet given criteria
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| **Introduction** |  |  |
| This is one of a series of resources that are designed to allow learners to use the theme of King Charles III’s coronation to develop their knowledge and skills in Design & Technology and Engineering. This resource focusses on designing an electrically powered Royal carriage for the event. |
| **Purpose of this activity**In this activity learners will make use of the theme of the King’s coronation to design a new carriage that is powered by electricity. They will consider the design brief and criteria for the carriage before sketching and annotating an idea to meet the given requirements.This activity could be used as a main lesson activity to teach about electrically powered vehicles and renewable energy. It could also be used as part of a wider scheme of learning focusing on sustainability issues within Design and Technology and Engineering.  |
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| **Activity** |  | **Teacher notes** |
| **Introduction (5-10 minutes)**Teacher to explain the task to learners and introduce the theme of the King’s coronation using slide 3 of the presentation.**Design brief and criteria (10-15 minutes)**Teacher to introduce the design brief and criteria on slides 4 and 5 of the presentation and discuss with learners. Explain that the carriage must:* Be electrically powered so it has a low carbon footprint.
* Show the King’s Cypher in a prominent location.
* Reflect the history and traditions of the United Kingdom and the Royal family.
* Include features to improve comfort when riding inside the carriage.
* Make use of modern, lightweight materials.

**Designing the carriage (20-30 minutes)**Learners to produce a sketch of an idea to meet the requirements of the design brief and criteria. Learners to annotate their idea to show how the requirements have been met.Teacher to show the example on slide 7 of the presentation to assist learners with producing their own designs.**Using a solar battery charger (10-20 minutes)**Teacher to show how an electric motor can be powered using two AA rechargeable batteries and how these can be charged using a solar panel.Learners to use the wiring diagram on slide 9 of the presentation to assemble their own electrically powered motor. Teacher to discuss with the class how this could be modified to power two or more wheels on a new Royal carriage. |  | **Introduction to task and theme**Discuss the coronation with learners, what this involves and its importance in the United Kingdom.Learners could research the history of the existing Gold State Coach and consider its benefits and limitations as a Royal carriage.Discuss the design criteria with learners and how they might meet them with their designs.**Producing the designs**Learners could use either the handout (slide 6 of the presentation) or blank paper to present their design idea and annotations.**Solar battery power**This activity is an optional extra task that could help learners to understand about solar energy and how this can be used to power electric vehicles.A solar charger such as this could be used: <https://www.amazon.co.uk/gp/product/B073W8VLTN> 2 x 1.5 V AA batteries will power a 3 V motor. An alternative rated motor can be used as long as the power supply used provides the correct voltage for it to function correctly and safely. As an additional activity learners could try charging batteries using a solar cell and use them to power a motor. They could then discuss how this system could be modified to create a two- or even four- wheel drive system for the carriage.The wiring diagram on slide 9 of the presentation can be used to help when connecting solar charged batteries to a motor to produce the drive for the carriage.Always take care when working with electrical power supplies and components, even at low voltages. |
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| **Basic** |  | **Extension** |
| * Provide a template for the carriage or partially completed design idea.
* Provide a wiring diagram to help with assembling the electrically powered motor circuit.
 |  | * Design a mechanical system to convert the rotary motion from the motor to the movement of the carriage (e.g., driving two or four wheels).
* Produce a functional scale model of your proposed design and test how well it works.
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| **Resources** |  | **Required files** icon-docicon-pdficon-ppt |
| * Pens, pencils and coloured pencils
* A4 or A3 paper
* 3 V motors
* Rechargeable AA batteries
* AA battery packs
* Red and black wires/crocodile clips
* AA solar battery charger
 |  |  Presentation – Royal carriageicon-pdf Handout – Royal carriage worksheet |
| **Additional websites** |  |  |
| * **The official royal website for the coronation:** https://www.royal.uk/coronation
* **Royal Family - King’s Coronation:** Information about the plans for the coronation from the official Royal Family website. <https://www.royal.uk/coronation-weekend-plans-announced>
* **BBC News – King’s Coronation:** Information about the King’s coronation and the stages that make up the ceremony. <https://www.bbc.co.uk/news/uk-63543019>
* **Wikipedia – Gold State Coach:** Information about the existing UK Royal carriage. <https://en.wikipedia.org/wiki/Gold_State_Coach>
* **Royal Collection Trust – Design a carriage:** Teaching and learning materials to support the designing of a new Royal carriage, including a worksheet template. <https://www.rct.uk/resources/pdf-pack-design-a-carriage-activity-sheet>, <https://www.rct.uk/sites/default/files/Design%20a%20Carriage.pdf>
* **Amazon – Solar battery charger:** A potential battery charger that could be used for the solar power activity. <https://www.amazon.co.uk/gp/product/B073W8VLTN>
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| **Related activities (to build a full lesson)** |  |  |
| **Starters** (Options) * Analyze the benefits and limitations of the current royal carriage.
* Discuss the benefits and limitations of using electrical power supplies to power vehicles.
 | **Plenary*** Evaluate the designs produced.
* Self/peer assess the completed designs.
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| **The Engineering Context**  |
| * Engineers have a moral and ethical responsibility to ensure that their designs are sustainable and do not negatively impact on the environment. This includes using renewable energy wherever possible to power systems and devices.
* Electrical, electronic and control engineers need to have knowledge, understanding and skills associated with circuit assembly, including following wiring diagrams.
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| **Curriculum links** |
| **England: National Curriculum**Design & Technology * KS3 1b, 1e
* KS3 2a, 2b
* KS3 3b, 3d
* KS3 4c

**GCSE D&T**AQA D&T* 3.1.1, 3.1.2, 3.1.4, 3.2.1, 3.2.3, 3.3.2, 3.3.4, 3.3.5

Edexcel D&T* 1.1.3, 1.1.7, 1.2.4, 1.3, 1.14, 1.17, 5.2.3d

Eduqas D&T* Core: 1, 2, 3, 5,
* Electronic systems: 1, 2

OCR D&T* 1.1a, 1.2a, 2.1a, 2.2a, 3.1a, 3.2, 4.1a, 5.2c, 6.4b
 | **Northern Ireland Curriculum**Technology & Design* KS3 Communication – use of free-hand sketching and formal drawing techniques and ICT tools (including 3D modelling)
* Objective 3 - Pursue design solutions using environmental friendly materials and energy sources.
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| **England: GCSE Engineering*** 3.1.3, 3.3.2, 3.5

**Scotland: Curriculum for Excellence**Technologies* TCH 3-05a, TCH 3-07a, TCH 3-11a
 | **Wales: National Curriculum** Design and Technology* KS3 Skills: Designing 1, 2, 3, 4, 6
* KS3 Systems and controls: 16, 18
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| **Assessment opportunities** |
| * Formal teacher assessment of finished design ideas.
* Self/peer assessment of designs produced.
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