**Design and Technology: Y5/6 Spring 2, Cycle B**

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| **Design and Technology: Design and Make a Viking Related Model with a Simple Mechanism** | **Key Stage 2** | **Cycle B** |
| **National Curriculum Objectives** | **Declarative Knowledge (I know…)** | **Procedural Knowledge (I can…)** |
| Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. When designing and making, pupils should be taught to: **Design*** use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups
* generate, develop, model and communicate their ideas through discussion, annotated sketches,
* select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately
* select from and use a wider range of materials and components, including construction materials, according to their functional properties and aesthetic qualities

**Evaluate*** investigate and analyse a range of existing products
* evaluate their ideas and products against their own design criteria and consider the views of others to improve their work
* apply their understanding of how to strengthen, stiffen and reinforce more complex structures
* understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]
 | * I know the names of simple mechanisms.
* I know what the different cams and followers are and how they make different movements in a mechanism.
* I know which cams will make a simple machine move in a different way.
* I know how to use research and develop design criteria to inform a design.
* I know how to build a framework, accurately using a wider range of tools and equipment.
* I know how to build a moving model using cams and followers.
 | * I can explain simple mechanisms giving examples from the every day.
* I can explain what a cam and follower are identifying them on mechanisms
* I can demonstrate how rotary motion is converted into linear motion in a mechanical system.
* I can make a mechanism and change the shape of the cam to see how this changes the movement of the follower.
* I can choose the appropriate cams and followers for my design to move in an appropriate way.
* I can demonstrate how to join materials using card triangles or wood.
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| **Prior Learning:****Y3/4 – Using Levers to Make a Catapult**Generate, develop annotated sketches and prototypes to model and communicate ideas for their Roman pop-up book.Use annotated sketches and prototypes to develop, model and communicate ideas.Build on KS1 experience of basic cutting, joining and finishing techniques with paper and card.Order the main stages of making. Select from and use appropriate tools to cut, shape and join paper and card.Select from and use finishing techniques suitable for the product they are creating.Investigate and analyse books and other products with lever and linkage mechanisms.Evaluate their final product against the design criteria for their Roman pop-up bookBuild on prior use of mechanisms such as flaps, sliders and levers.Understand and use lever and linkage mechanisms.Children to distinguish between fixed and loose pivots.Key vocab: mechanisms, lever, linkage, slot, guide (bridge), loose/fixed pivot. | **Assessment Task:** Following their final evaluations, children are to label and annotate a photo of their finished moving Viking. On it, they should label and annotate:* Specific design features (e.g. strengthened corners)
* Specific cams used to create particular movements
* How the mechanism is working.
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| **Common Misconceptions:** | **Vocabulary** |
| **Lesson 1** | **Science – Forces Spring 1 – Lesson 6****Levers pulleys and gears** To explain simple mechanisms.What is a mechanism? Watch videos:Gears: <https://www.sciencekids.co.nz/videos/physics/gears.html> <https://technologystudent.com/gears1/geardex1.htm> Pulleys: <http://www.watchknowlearn.org/Video.aspx?VideoID=56666&CategoryID=1745> Levers: <https://www.bbc.co.uk/bitesize/clips/zrp6n39> Introduce levers, pulleys and gears. Children made notes on each on jigsaw sheet.Share info – write definitionsIdentify which machines use which mechanism – children draw table and put each item in correct column.Plenary – Quiz. | Levers, pulleys, gears, mechanism, machines. |
| **Lesson 2** | **Cams and Followers**L.O. - To explain and demonstrate how simple cam mechanisms work.Explain that the children will be using a mechanical system, which uses cams, to make their animals move. Look at the first mechanical system on the **Basic Cam Mechanism Vimeo File**. How is this wooden toy moving? How many parts does it have? How are the parts joined? Explain that the children will see some mechanisms which work in a similar way to the animal models they will make. Watch the rest of the video. Discuss what the children have seen/learnt from the clip.**Components:** Share information about cams and followers using the **Lesson Presentation**. Watch the **Basic Cam Mechanism Vimeo File** again. For each mechanism ask: Can you identify the cam? Can you identify the follower? Where is the rotary motion used? Where is the linear motion used? (Note that for the turntable it is all rotary motion.) Discuss how, for most of the mechanisms, the rotary motion is converted into linear motion. Which is the exception to this? (The turntable.) How does this work?**Activity:** Children draw and label three different cam mechanisms and add on any other findings.Tell the children that the shape of the cam changes the movement. Ask the children to try to match up the cams to their names. Reveal the answers.Explain how using an egg-shaped cam would change the movement. Repeat for a snail-shaped cam.Demonstrate how to make a snail-shaped cam mechanism following the differentiated **Exploring Cam Movement Activity Sheet (in booklet)**. Use the **Cam Template Activity Sheet (in booklet)** to get the correct sizing for the cams. Discuss the different use of sheet materials. Why is thick corrugated card used to make the cam? (The thickness provides a surface for the follower to run over.) Why is thick card necessary for the background? (The stiffer material provides more support for the mechanism.) Why is thick corrugated card used to guide the lolly stick? (Thick card provides a more structured guide which prevents the lolly stick from sliding out.) Why is thin card used to go over the guides to hold them in place? (The thin card is less rigid so can bend over the guides easily and allows the lolly stick the move.) Make sure children understand the key safety aspects.Also explore what happens when they add in different shaped cams. They must accurately follow the measurements on the instructions to the nearest cm**Discuss** what they discovered when they changed the shape of the cam | Cam, follower, mechanism, components, mechanical systems, rotary, linear, convert, motion, guide, movement, dwell, snail, egg-shaped, , eccentric, ellipse, hexagon, round, off centre, offset. |
| **Lesson 3** | **Designing**L.O. - To use research and develop design criteria to inform a design.**Design Brief:** Tell the class that it is now time for every child to design their own moving Viking. Remind them of the design brief. **How Will We Make It?** Show the picture of the mechanical systems. The children will be making a frame to support the mechanism for their moving animal. Explain that the frame can be made in different ways. They will need to choose their materials for the cams and the moving top part of the mechanism.**CAFEQUES**: Explain that the acronym ‘CAFEQUES’ will be used today to help them develop their own design criteria. Explain what the acronym means using the **flipchart**. Discuss ideas as a class about how to use the table to create design criteria. Children work independently to create their own design criteria.**Design Ideas:** Children will Viking character to focus on. Look at the **Design Sheet (in booklet)** and discuss how to complete the different sections. Discuss the importance of the decoration surrounding the mechanism which gives the product its finished quality. Tell the children that they will now create and clearly communicate their own designs. Remind children to be innovative with their designs and consider the design criteria and the information about animal movement, appearance and habitat.**Using Design Criteria:** How were the design criteria helpful at the early stage of product development? | Design criteria, functional, aesthetic, design features, innovative, research, finished, quality. |
| **Lesson 4** | **Making the Frame**L.O. - To build a framework, accurately using a wider range of tools and equipment.**Making the Frame:** Explain that the frame can be made in different ways. Explain that most of the children will be cutting wood to make their frame. See the **Using Tools Safely In Design and Technology Adult Guidance**. Demonstrate how to safely cut square section wood using a junior hacksaw and a bench hook. Explain that the children should aim to cut the wood accurately to within 1mm to create a level framework. Demonstrate the use of sandpaper to help smooth and finish off any rough edges. Show how to use triangles and PVA glue to join the square section wooden frame together and strengthen it. Go over the ‘key tips for creating a quality finish.’ | Design criteria, functional, aesthetic, materials, components, framework, construction, finish, join, cut, saw, square section wood, hacksaw, vice, corner joints, framework, measure, accurately, smooth, finish, notch. |
| **Lesson 5** | **Making the Moving Viking**L.O. – I know how to use a mechanical system to create a moving model.**Evaluating Ideas:** Watch a short video clip of a **Prototype Moving Automata Animal**. As children watch, they use the questions on the **Lesson Presentation** to help them evaluate the prototype. After watching, demonstrate how to give constructive feedback to help the person improve their design.**Peer Evaluation:** Children work with a partner to evaluate their designs using the **Peer Evaluation Sheet (in booklet)** and their completed design criteria. Children should use their design criteria to help them evaluatethe design. They then need to discuss ideas about ways to proceed. (This allows peer feedback andencourages children to verbalise and think through their own design before they start to make it.)**Making the Mechanical System:** Demonstrate how to accurately use a saw to cut dowel. Show how to attach the doweling through the cam hole and how to mount the mechanism into the framework, emphasising the importance of measuring carefully before gluing into place. Explain the need for a guide to keep the follower in place. Show how to use small pieces of plastic tubing pushed onto the dowelingto hold the cam in place. Show an example of how a handle can be made by attaching a small wheel to one end of the axle/shaft. The wheel should have a hole drilled off-centre with a small piece of doweling pushed into the hole. Discuss how to add detail to the surroundings to create a quality finished product. Children will be following their own design, measuring accurately. They will be working mainly independently.**Final Evaluation:** Why do we complete a final evaluation? (To assess whether the product has achieved the aims set out in the brief/design criteria.) Complete the differentiated **Final Evaluation Sheet (in booklet).** Children will evaluate their poster against the design criteria focussing on whatthey did well and what they could improve.**Peer Feedback:** In the same pairs as earlier, children share and discuss their end products, focussing on how the changes made impacted on their final design. | Design criteria, functional, aesthetic, materials, components, cam, mechanical systems, mount, framework, finish, join, cut, saw, prototype, evaluate, peer, feedback, off centre, axle, shaft. |
| **Lesson 6** | **Assessment Activity**Following their final evaluations, children are to label and annotate a photo of their finished moving Viking. On it, they should label and annotate:* Specific design features (e.g. strengthened corners)
* Specific cams used to create particular movements
* How the mechanism is working.
 | All the above. |

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