Summer Term Overview Year 5 and 6 – DT

Summer Term Book – Mortal Engines		
Topic – Automata Animals		**Guide Time = 7 lessons**
Assessment:	Questions from reading for productivity sessions Teacher judgement of skills used to design and make their model Pupil's evaluation of product	**Very Important Points (VIPs):** • The starting point for any design is the design brief. • The brief outlines what problem a design will solve. • It should be referred to throughout the project to make sure what you are working on will solve this problem. • A cam is a wheel attached to a crankshaft. • A crankshaft is the rotating shaft a crank is joined to. • A follower is a bar that follows a cam around its circumference. • The shape of the cam changes the movement. • Design criteria are the precise goals that a project must achieve in order to be successful. **Fat Questions:** How could automata animals help to save an endangered species? How are cams and followers used in everyday machinery? Consider new ways to use cams and followers to make your life easier now and in the future. How do you think cams would have been used in Mortal Engines?
Links to prior learning (sequencing) and canon book	Link to prior skills: Children have designed, made and used evaluative skills in previous lessons. In KS1 children design products involving levers so will be familiar with moving parts. In LKS2 children have studied how to strengthen structures which will be important when making their frameworks. The non variable skills will be researching, designing and making a product that is fit for a particular purpose, that meets the design criteria. Links to book – Mortal Engines has cities on wheels – mechanisms.	
Links to other learning (cross fertilisation)	Maths – measuring lengths of wood, angles for joining wood, understand how triangles used to strengthen corners. Geography – habitats of different animals, endangerment Reading – Canon book is about mechanisms and cities that are on wheels etc Science – Links to classification of animals Thematic Questions: The World Beyond Us: How would a cam be useful on Mars? How have cams made space travel possible? The World Around Us: How are cams and followers used in different machines? Which machines use cams and followers as part of their mechanism? Modern Britain: How did the invention of cams change machinery? What will replace cams and followers in the future? Healthy Bodies & Healthy Minds: What sort of machinery could cams and followers be used in to help us stay healthy? How have cams contributed to advances in modern medicine?	

	Culture: How are cams used in the production of films and theatre productions? How have cams in printing presses enabled progress in the art world? Technology in Action: If you could make any invention with a cam, what would you make? How could cams be used in robots?	
Links to future learning	Children will continue to further develop and gain experience of the knowledge, understanding and skills needed to engage in an iterative process of designing and making. They should work in a range of industrial contexts [for example, engineering, manufacturing, construction, food, energy, agriculture (including horticulture) and fashion], where these skills can be applied purposefully. They will use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses and further develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools. Children could study cams and followers if they went on to study Design Technology at GCSE level.	
Character/Wider Development ('50 things', cultural capital, skills)	Visit the library to explore different information books about animals. Engage in activities related to conservation of the environment and protecting vulnerable species. Celebrating Earth Day could be on way of further exploring conservation and sustainability of our world. Each school has its own set of 50 things which can be used to make pertinent real-life, wider context links for the children.	

OVERVIEW OF TEACHING SEQUENCE

Key Facts/Learning	Learning Focus or Key Question	Learning Outcomes (NC)	Key Words/ Vocabulary	Greater Depth/SEND	Misconceptions	Activities and Resources
Summer 1 Lesson 1 The starting point for any design is the design brief. The brief outlines what problem a design will solve. It should be referred to throughout the project to make sure what you are working on will solve this problem.	To research ideas about different animals to inform my 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.	Endangered vulnerable appearance habitat research design brief	GD – Up to 9 different animals to research. Should be able to use very specific vocabulary to describe the aspects they are researching. SEND – Will research the movements, appearance and habitats of one more different animal. Could record in different ways e.g. pictures	That animals are no longer in danger of going extinct. That there is nothing we can do to prevent animals from becoming extinct. They may not know that the WWF holds information on endangered and vulnerable animals.	Explain who the WWF (World Wide Fund for Nature) are. Explain the design brief – to create a collection of appealing moving mechanical animal models (automata animals) that will captivate people's interest. Explain that there are certain animals that are endangered/vulnerable that the WWF would like to focus on. Watch the video of a sea turtle (it is better to have the sound turned off to help children focus on the movement, appearance and habitat) Children complete the sea turtle part of the sheet. Repeat for the penguin. Take feedback from the children about both animals, focusing on the contrast between the smooth, slow movements of the sea turtle compared to the quick, jerky movements of the penguin. Children to begin research task. Year 5 – will research the movement, appearance and habitats of up to five different animals. Year 6 – will have up to seven different animals to research. This will allow them more choice when making the product. Resources and slides on Trust shared. **Deepen the moment** Year 5 – What do you think has caused the endangerment of some of the animals that you have researched?

						Year 6 – What sort of mechanism do you think would create the sort of movement your chosen animals make?
Lesson 2 A cam is a wheel attached to a crankshaft. A crankshaft is the rotating shaft a crank is joined to. A follower is a bar that follows a cam around its circumference.	To explain how simple cam mechanisms work	Understand and use mechanical systems on their products (for example cams)	cam follower mechanism components mechanical systems rotary linear convert motion	GD – differentiate between rotary and linear motion when drawing and labelling the cam mechanisms SEND – Draw and label only. Can explain verbally what a cam and what a follower is.	Children may not know that there are different types of motion and may need more of an explanation/ demonstration of rotary and linear motion.	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. Share information about cams and followers. 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? Children begin task. Year 5 – Explain what a cam and follower is. Draw and label one mechanism. Explain how a cam mechanism helps something move up and down. Year 6 – Explain what a cam and follower is, draw and label three cam mechanisms. Explain how a

						cam mechanism helps something move up and down and describe any other findings. Resources and slides on Trust shared. **<u>Deepen the moment</u>** Year 5 – How did the invention of cams revolutionise machinery? Year 6 – What might replace cams and followers in the future?
Lesson 3 The shape of the cam changes the movement.	To make a simple mechanism, selecting materials for their properties	Understand and use mechanical systems in their products (for example cams) Select from and use a wider range of materials and components, including construction materials according to their functional properties and aesthetic qualities	cam guide follower mechanism components mechanical systems rotary linear convert movement dwell snail egg-shaped eccentric ellipse hexagon round off centre offset	GD – Can make the cams without the use of a template. Will be able to accurately predict what movement will occur. SEND – Will only make the snail-shaped cam and may need heavy adult support to measure and cut accurately, as well as putting the mechanism together correctly.	That all cams are round. That the centre hole doesn't make a difference, only the shape of the outside.	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. Use the sheet 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. Year 5 – Will try out different shaped cams. Year 6 – Will replace the cam with different shapes and explain what happens.

						Resources and slides on Trust shared. **<u>Deepen the moment</u>** Year 5 – Match the cams you have made to animals who have similar movement patterns. Year 6 - Match the cams you have made to animals who have similar movement patterns and write a paragraph explaining why.
Lesson 4 Design criteria are the precise goals that a project must achieve in order to be successful.	To research and develop design criteria	Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at individuals or groups.	Design criteria functional aesthetic design features innovative research finished quality	GD – through outcome – children should push themselves to complete a more complex design. SEND – Children will work in a group with an adult to support. *For part 2, children will discuss and then complete a shared design.*	That a designer just designs something they would like to see.	Tell the class that it is now time for every child to design their own moving animal. Remind them of the design brief. Explain what design criteria are and their importance. What would happen if we didn't use design criteria? Show the pictures 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. Explain that the acronym 'CAFEQUES' will be used today to help them develop their own design criteria. Explain what the acronym means. Discuss ideas as a class about how to use the table to create design criteria. Children complete the design criteria sheet. Children will then choose one of the animals from lesson 1 to focus on. Look at the 'Automata Animal design' sheet 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 the animal movement, appearance and habitat. Year 5 – Part 1 – children work independently to create their own design criteria.

						Part 2 – Children use blank paper to create ideas based on their research. Year 6 – Part 1 – children work independently to create their own design criteria. Part 2 – Children use blank paper to create ideas based on their research. They should also aim to create a design which has at least two moving parts. Resources and slides on Trust shared. **Deepen the moment** Year 5 – Explain the purpose of design criteria. Year 6 – Explain how changing your design criteria could affect your final design.
Lesson 5 Ensure key safety tips are shared with the children.	To build a framework accurately using a wider range of tools and equipment	Select from and use a wider range of tools and equipment to perform practical tasks (for example cutting, shaping, joining and finishing) accurately.	Design criteria functional aesthetic materials components framework construction finish join cut saw square section wood hacksaw vice corner joints measure accurately smooth notch	GD – Outcome – a sturdier framework. Following on from earlier lessons, GD children will be working with more complex, and multiple, mechanisms. SEND – Can be given the option of using a cardboard box to create the framework and reinforced corners.	That you have to press down hard when sawing.	Explain that today the children will start to make their automata animals. Revisit the design criteria. 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 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'. Year 5 – make a framework from square section wood Year 6 – make a more challenging framework from cut strip wood, joining together with pin nails. Resources and slides on Trust shared. **Deepen the moment**

						Year 5 – Write the safety rules someone should follow when cutting wood. Year 6 – Create a safety leaflet or poster, outlining the steps that should be taken to remain safe when using saws and hammers.
Lesson 6 (Key safety tips)	To use peer evaluation to finalise my design	Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work Understand and use mechanical systems in their products	design criteria functional aesthetic materials components cam mechanical systems mount framework finish join cut saw prototype evaluate peer feedback off centre axle shaft	GD – Will have a more detailed, finished quality. SEND – Work in a group with adult support	Children may not realise what the hole in the cam is for. Children may not realise what a useful tool peer evaluation can be in wider curriculum subjects. They also may not be proficient in giving useful feedback.	Watch a short video clip of a prototype moving automata animal. As children watch, they use the questions on the slides to help them evaluate the prototype. After watching, demonstrate how to give constructive feedback to help the person improve their design. Children work with a partner to evaluate their designs using the Peer Evaluation sheet and their completed design criteria. Children should use their design criteria to help them evaluate the design. They then need to discuss ideas about ways to proceed. This allows peer feedback and encourages children to verbalise and think through their own design before they start to make it. Demonstrate how to accurately use a saw to cut dowel. Show how to attach the doweling through the cam hole and how to measure carefully before gluing in 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 doweling to 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 hold 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. Year 5 – Children will continue to work on their models, focussing more on the decorative aspects. Year 6 - Children will continue to work on their models, focussing more on the decorative aspects.

						Resources and slides on Trust shared. **Deepen the moment** Year 5 – Give three examples of constructive feedback and three examples of feedback that is not constructive. Year 6 – Write a paragraph explaining some of the constructive feedback you received, and how you made changes to your work as a result.
Lesson 7 Try to think objectively about your work. Be honest with yourself about how well you have met the criteria.	To complete the final evaluation	Evaluate their ideas and products against their own design criteria	design criteria finish prototype evaluate peer feedback	GD – will have a fuller understanding of where they met the design criteria and where they could improve. SEND – Children will evaluate their work against the design criteria focussing on what they did well.	Children may assume that they have met all of the criteria or maybe find it difficult to see where they could improve as they are too close to the project.	Final evaluation. Ask children – why do we complete a final evaluation? (To assess whether the product has achieved the aims set out in the brief/design criteria. Children to complete the final evaluation sheet. Year 5 – Children will evaluate their work against the design criteria focussing on what they did well and what they could improve. Year 6 – Children will evaluate their work against the design criteria focussing on what they did well and what they could improve. They will also evaluate against the specifications of the design brief that they set for themselves. **Deepen the moment** Year 5 – What advice would you give to another child just beginning this project? Year 6 – If you began this project again, what would you do differently?
Context (big picture learning) In this unit, pupils will primarily learn how to research, design / plan, make and evaluate a product that is functional, fit for purpose and meets the design criteria. They will take the imagery of cities on wheels and transform this into a project about creating a moving model of an endangered animal. They will consider how the animal moves and where it lives as part of their final design, using an appropriately shaped cam to emulate the animal's movement. They will learn practical skills such as sawing and hammering and will evaluate their project throughout, ensuring it meets the brief they were given and the criteria they devised for themselves.						

Link to resources: IWB slides, accompanying resources lesson by lesson, reading for productivity one for each lesson.

Folder name (Trust Shared>Primaries>Departments>KS2>Year 5&6 Curriculum Planning>Cycle B>Summer – Mortal Engines>DT)

Knowledge Organiser - DT

Vocabulary

design brief – a written explanation given to a designer, telling them the aims and objectives of a design project.

Cam – a rotating or sliding piece in a mechanism used especially in transforming rotary motion into linear motion.

Follower – the part of a machine in sliding or rolling contact with a rotating cam and given motion by it.

Mechanism – a system of parts working together in a machine

Components – parts or elements of a larger whole.

mechanical systems – a set of physical components that convert an input motion and force into a desired output motion and force.

Rotary – revolving around a centre or axis

Linear – in a straight line

Convert - change

Motion - movement

Dwell – a slight regular pause in the motion of a machine

Functional – designed to be practical and useful, rather than attractive. Has a special purpose.

Aesthetic – a set of principles underlying the work of a particular artist or movemement

innovative – features new methods or is original in some way

prototype – the first version of a device

VIPs

The starting point for any design is the design brief.

The brief outlines what problem a design will solve.

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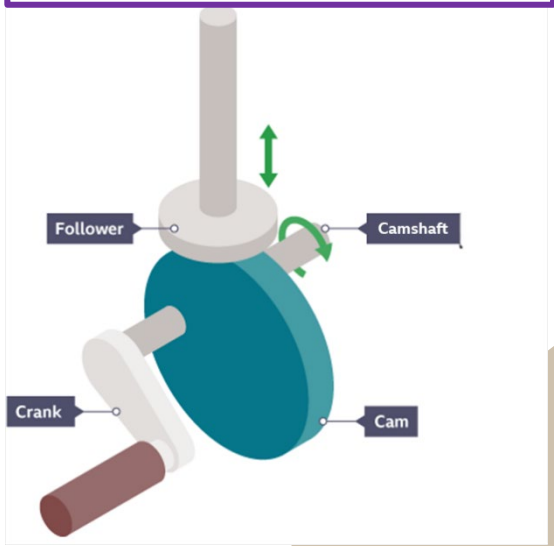
A crankshaft is the rotating shaft a crank is joined to.

A follower is a bar that follows a cam around its circumference.

The shape of the cam changes the movement.

Design criteria are the precise goals that a project must achieve in order to be successful.



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Fat Questions

How could automata animals help to save an endangered species?

How are cams and followers used in everyday machinery?

Can you think of any new ways to use cams and followers to make your life easier?

How do you think cams would have been used in Mortal Engines?

Subject Intent – You will have the opportunity to design and create an automata animal using wood, saws and hammers. You will have to become an effective communicator in order to share your design ideas and to help your peers to evaluate their work.