

Context						
Unit	<a href="#">Mechanical Systems: Automata toys</a> Linked to History: Industrial Revolution (Victorian inventions)					
Assessment	Evaluation of product at end of unit.					
Concepts - How does this unit fit in?	<b>Significant Designers / Products</b> Isaac Merrit Singer (sewing machine) Karl Benz (first motor engine)		<b>Noteworthy Products in our Daily Lives</b> Car engines, Singer sewing machine, repetitive automated machinery		<b>Purpose and Use</b> To transfer rotary motion, into linear motion, to enable a machine to perform a task.	
Kapow Lesson	Learning Intention	DT Skills Skills Progression	Knowledge Concepts	GRADES	Local Art	Curriculum Links
1	<a href="#">L1 Automatas</a>	To <b>explain</b> rotary and linear motion, using my cam and follower mechanism diagram.	D11, D19, D10, D19			History: Industrial Revolution
2	<a href="#">L3 Experimenting with Cams</a>	To <b>explain</b> how my mechanism moves, using technical vocabulary.	D8, D17, D21, D22, D25 M18, M30, M31, M32, M25, E8.E5, E6, E10			Science: Forces
3	-	To <b>design</b> a product and <b>explain</b> how it meets the design criteria.	D24, D25, D22, D26			
4	<a href="#">TinkerCAD - Computer Aided Design</a>	To <b>combine and manipulate</b> objects on a workplane, to make a 3D model of a cam.	D20, D24, D25, D26 M19, , M24, M29, E5, E9			
5	<a href="#">L3 Experimenting with Cams</a>	I can overcome building challenges by <b>analysing</b> and solving the problem using peer discussion.	M18, M30, M31, M32, M23, M24, M25, M26, M27, M28, M30, M31, M34, M35, M36			
6						
7		To present and evaluate a cam mechanism	M34, M35, E7, E9, E11, E12, E13, E14, E15			

The Design Process Research > Design > Construct & Amend Design > Test > Evaluate

## Lesson 1

<b>Kapow Lesson</b>	<a href="#">L1 Automatas</a>
<b>Learning Intention</b>	To <b>explain</b> rotary and linear motion, using my cam and follower mechanism diagram.
<b>SOLO SC: Uni- Structural</b> <i>Bronze</i>	I can <b>identify</b> the target audience for my product
<b>SOLO SC: Multi- Structural</b> <i>Silver</i>	I can <b>describe</b> rotary and linear motion to my partner.
<b>SOLO SC: Relational</b> <i>Gold</i>	I can <b>explain</b> rotary and linear motion, using my mechanism diagram.
<b>SOLO SC: Extended Abstract</b> <i>Platinum</i>	I can <b>hypothesise</b> the final aesthetic and motion/s of the product with my group.
<p style="text-align: center;"><b>Activity</b></p> <p>(What will the children do to demonstrate their understanding of the LI?)</p>	<p><b>Chn will discover inventions from the Victorian era which utilise cam and follower rotary-to-linear motion and will be introduced to key inventions and designers. Chn will become familiar with the two types of motion produced by a cam &amp; follower system and will observe different cam shapes in action to understand the different linear motion that can be produced. Introduce what toys chn would have played with in the Victorian era and then set design brief. Chn to create a design that will entertain and educate Victorian children about life in 21st Century.</b></p> <p><b>Do not follow Kapow lesson but use selected slides</b> - see lesson below.</p> <p>Show and discuss <a href="#">Victorian inventions and inventors</a> - Isaac Merrit Singer (sewing machine), Karl Benz (first motor engine). Notice how the machines have parts that have <b>rotary motion</b> which in turn, creates <b>linear motion</b>. <b>Why are these types of motion helpful? Their purpose?</b></p> <p>Show Victorian toys on <a href="#">Kapow slides 2-4</a> and share <a href="#">YouTube Video</a>. Why might Victorian children be entertained by/like these toys? Cherished due to how they were made / given - no modern technology like games consoles, they were a fun distraction from poverty or work.</p> <p>Design brief: <b>“Design and build automata that will entertain a Victorian child as well as teach them about life in the 21st Century”.</b></p> <p><b>Introduce 3 main cams and label a cam and follower mechanism diagram.</b> <b>Annotate types of motion and other plausible keywords.</b> Share video of previously made Cam and Follower toys by Miss Manjdadria - videos introduce/reinforce motion terms.</p>

	<p>Chn brainstorm what moving image/ scene/idea they would like to create. Work in teams of 3-4.</p> <p>If time, show motor engine animation, showing rotary and linear motion in a 4 stroke engine - a development from the simpler engine that was built by Karl Benz.</p> <p>Ensure neat presentation of work in books, incl joined handwriting. Diagrams must be drawn with pencil and straight lines must be drawn with a ruler. Diagram annotations must be written in pen.</p>
<b>Key Vocabulary for the lesson</b>	Moving toy, automama, cam, follower, follower base, design brief, product , target audience, rotary motion, linear motion, axle, camshaft
<b>Curriculum Links</b>	History
<b>Resources</b>	Kapow lesson, video, sketchbooks, simple cam and follower mechanism diagram

## Lesson 2

<b>Kapow Lesson</b>	<a href="#">L3 Experimenting with Cams</a>
<b>Learning Intention</b>	To <b>explain</b> how my mechanism moves, using technical vocabulary.
<b>SOLO SC: Uni- Structural</b> <i>Bronze</i>	I can <b>find</b> appropriate materials to make my mechanism
<b>SOLO SC: Multi- Structural</b> <i>Silver</i>	I can <b>perform construction skills</b> to make a moving mechanism.
<b>SOLO SC: Relational</b> <i>Gold</i>	I can <b>explain</b> how my mechanism moves, using technical vocabulary.
<b>SOLO SC: Extended Abstract</b> <i>Platinum</i>	I can <b>evaluate</b> the mechanism and suggest future improvements.

<p style="text-align: center;"><b>Activity</b></p> <p>(What will the children do to demonstrate their understanding of the LI?)</p>	<p>Chn to recap Design Brief and will experiment with cam and follower components to construct a moving mechanism; they will understand how the mechanism is constructed and will encounter problems during this process which they will need to solve through teamwork, communication skills and continued evaluation of the product. Chn will then revisit their initial design ideas and will sketch a final design after seeing the motions that different cams produce. Chn will disassemble the non-permanent mechanisms, so that the resources can be used for constructing the final products.</p> <p><b>Do not follow Kapow lesson, but video showing mechanism construction can be used to demonstrate what to do - BUT NOTE, no glue guns to be used this lesson as the mechanism is to be disabled.</b></p> <p>Show videos of previously made automata by Miss Manjhadria, once more. Recap vocabulary. Recap Design Brief: <b>“Design and build automata that will entertain a Victorian child as well as teach them about life in the 21st Century’.</b></p> <p>Show <a href="#">Kapow video of how to construct a cam and follower mechanism</a>.</p> <p>Chn will not use glue guns but will affix cams and followers using tape.</p> <p>To minimise the use of resources during this lesson, divide the class and assign certain groups to focus on making a mechanism using one specific type of cam. <b>Chn to present their prototypes and explain how they work, using technical vocabulary.</b></p> <p>Once all have been built, allow chn to engage with each other's constructions, to see the cam/follower movements in action. If mechanisms are not secure, they will break - use this as a teaching opportunity to discuss how structures need to be secured, regardless of the fixing used (tape or glue gun).</p> <p>Glue guns will be used during the construction of the final product. Q: How will the use of glue guns be beneficial in the construction of the final product?</p> <p><b>Promote resilience - chn must work independently and rely on peer support and group discussion to solve and overcome construction challenges. Class teacher intervention must be minimal, unless where there is a specific learning need.</b></p> <p><b>Take photos of the construction process - print and stick into sketchbooks as evidence of the design process.</b></p>
<p><b>Key Vocabulary for the lesson</b></p>	<p>Automama, cam, follower, follower base, design brief, rotary motion, linear motion, axle, camshaft, dowel,</p>
<p><b>Curriculum Links</b></p>	<p>History</p>
<p><b>Resources</b></p>	<p>Cardboard cam and followers, pre-punched cardboard boxes, masking tape / Sellotape, glue guns, foam washers, scrap paper, scissors.</p>

### Lesson 3

<p><b>Kapow Lesson</b></p>	<p>-</p>
<p><b>Learning Intention</b></p>	<p>To <b>design</b> a product and <b>explain</b> how it meets the design criteria.</p>
<p><b>SOLO SC: Uni- Structural</b></p>	<p>I can <b>name</b> my product</p>

<i>Bronze</i>	
<b>SOLO SC: Multi- Structural</b> <i>Silver</i>	I can <b>list</b> all the materials that I will need to build my product.
<b>SOLO SC: Relational</b> <i>Gold</i>	I can <b>design</b> a product and <b>explain</b> how it meets the design criteria.
<b>SOLO SC: Extended Abstract</b> <i>Platinum</i>	I can <b>predict</b> what difficulties I may encounter during construction.
<p style="text-align: center;"><b>Activity</b> (What will the children do to demonstrate their understanding of the LI?)</p>	<p><b>In design teams, the children will discuss and finalise their product design. Their design sheet will demonstrate their knowledge of the mechanism components; will explain why they believe their design will meet the needs of their target audience as well as show foresight of what may go wrong when they construct the toy in the next lesson.</b></p> <p>Recap the design brief: <b>“Design and build automata that will entertain a Victorian child as well as teach them about life in the 21st Century’.</b></p> <p><b>Class to work together to create Design Criteria;</b> key points to refer to to ensure they create an effective product. E.g.:</p> <ul style="list-style-type: none"> <li>● Shows what children like/enjoy in 2022 or Shows what our planet / environment is like</li> <li>● Moves with linear motion</li> <li>● Is humorous and will make the audience laugh</li> </ul> <p>Show slides: <a href="#">L3 Experimenting with Cams</a></p> <p>Show slides/video: <a href="#">L4 Finishing Touches</a> and <a href="#">Cam Mechanisms Miss M</a> - to show enthuse chn to not just have an item of interest placed on the top of the follower but to also ‘create a scene’ on the box - make the product aesthetically appealing.</p> <p>Model the expectation of what a finished design sheet should look like: labelled with technical vocab, annotations explaining what each part (mechanical and aesthetic) will do and what they are made from - EXT: explain why that material is used for that part (wood = sturdy; foam washer = hold axle in place; tissue paper = adds to aesthetic appeal...) Annotation can also make gestures towards the design criteria, and how their design has met these.</p> <p>Model expected handwriting and overall presentation.</p> <p>Chn may add colour to their design. They may choose to stick swatches of fabric, card, googly eyes.. Etc, or other materials that they wish to use on their design, into their sketchbook.</p> <p>Chn to make comprehensive list of what tools and materials they will required to construct their product.</p> <p>Chn to present their designs, in teams and explain why their product</p> <p>Design sheets should be stuck into sketchbooks neatly.</p> <p>Class teachers should make note of any specific materials that children will require when making their final product (eg, tissue paper, pipe cleaners, split pins) and have these ready for the next lesson.</p>
<b>Key Vocabulary for the lesson</b>	Automama, cam, follower, follower base, design brief, rotary motion, linear motion, dowel, final design, aesthetic appeal
<b>Curriculum Links</b>	History

**Resources**

Blank design sheets, teacher design model design sheet, pencils, rulers, handwriting pens, erasers, assorted decorating materials, colouring pencils

## Lesson 4

**Kapow Lesson**

[TinkerCAD - Computer Aided Design](#)

**Learning Intention**

To **combine and manipulate** objects on a workplane, to make a 3D model of a cam.

**SOLO SC: Uni- Structural**

*Bronze*

I can **identify** a workplane and basic CAD tools.

**SOLO SC: Multi- Structural**

*Silver*

I can **move and place objects onto the workplane.**

**SOLO SC: Relational**

*Gold*

I can **combine and manipulate** objects on the workplane, to make a 3D model of a cam.

**SOLO SC: Extended Abstract**

*Platinum*

I can **construct** different types of 3D cam shapes, using CAD.

**Activity**

(What will the children do to demonstrate their understanding of the LI?)

Children will learn how engineers use Computer Aided Design (CAD) to design mechanical components. How these are cost effective instead of spending money on expensive prototypes and how these models can be printed in 3D resin plastic. Children will learn that CAD can be used for game design, set design, medical research and many other uses. Chn will be given the opportunity to explore and tinker with 3D design with the aim of creating their own cam design. Chn will select basic shapes which when combined, will create a 3D rendering of a cam - a shape with a negative space within.

Class accounts will need to be set up prior to lesson and class teacher will need the class code for their children to join - see Digital Lead.

[TinkerCAD website](#)

(This lesson will build on previous learning in Year 5, where children constructed a virtual Micro:Bit holder.)

Model how to select and place basic objects on the workplane.

Model how to move the workplane so that a project can be viewed from different angles while creating.

Model how to shape and resize objects.

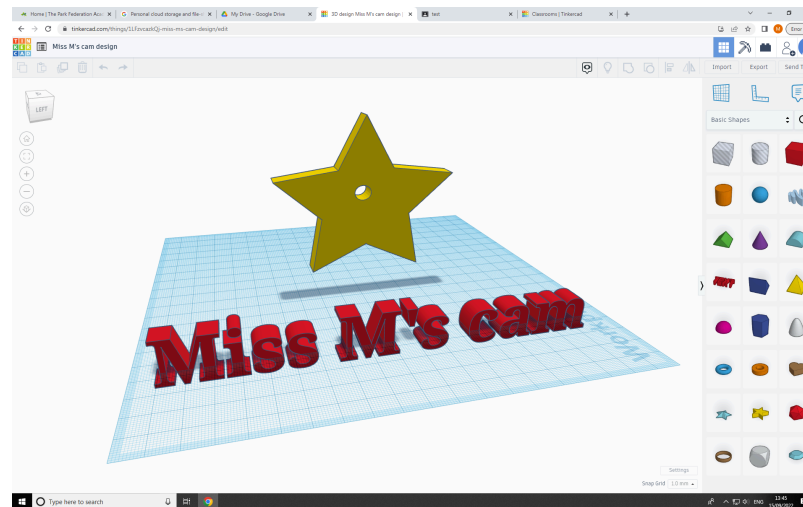
Select project on TinkerCAD which shows how to create a hole in another object.

Allow children to tinker with the aim to create their own cam shape - a shape with depth that has a circular hole through it.

Chn to screen shot their cam and upload it to GoogleClassroom.

Chn to sketch their cam into their sketchbook EXT: explain the process they took, to produce the 3D shape using CAD.

Class teacher to print designs from TinkerCAD/Googleclassroom (if function is available) and chn to stick these into sketchbooks.



[Link to this TinkerCAD project](#)

Steps to follow so as to make a Cam.

- Place object and resize.
- Place cylinder and resize
- Move cylinder through object.
- Cylinder > 'hole'
- Group object and cylinder
- Hole will be visible on object.

**Key Vocabulary for the lesson**

Computer Aided Design (CAD), TinkerCAD, workplane, shape, 3D, prototype, visualise

**Curriculum Links**

Computing, STEM, History

**Resources**

TinkerCAD (and classroom logins), chromebooks, cam images for reference

<b>Kapow Lesson</b>	<a href="#">L3 Experimenting with Cams</a>
<b>Learning Intention</b>	To overcome building challenges by <b>analysing</b> and solving the problem using peer discussion.
<b>SOLO SC: Uni- Structural</b> <i>Bronze</i>	I can <b>identify</b> and <b>select</b> the materials and tools that I will need.
<b>SOLO SC: Multi- Structural</b> <i>Silver</i>	I can <b>combine</b> materials using permanent joining techniques.
<b>SOLO SC: Relational</b> <i>Gold</i>	I can overcome building challenges by <b>analysing</b> and solving the problem using peer discussion.
<b>SOLO SC: Extended Abstract</b> <i>Platinum</i>	I can <b>perform continued evaluation</b> of my project, while building.
<b>Activity</b> (What will the children do to demonstrate their understanding of the LI?)	<p><b>Chn will work in design construction teams to build their moving toys. Chn will be given minimal class teacher support. To meet LI, chn <u>must</u> rely on peer support, discussion and continuous formative evaluation of their product during the building process. This is a key part of the design process and photos must be kept as a record of this lesson. Teacher must circulate and pose questions about construction decisions to enthuse the use of technical vocabulary and for chn to openly discuss their thought processes.</b></p> <p>Use construction video in <a href="#">L3 Experimenting with Cams</a>, to model / demonstrate how to attach cams and followers, using glue guns.  <b>HEALTH &amp; SAFETY - Enforce glue gun safety warning</b> - hot glue and metal will burn, so not to touch with fingers. Glue guns must be placed carefully on paper which will catch drips from the metal nozzle. Glue guns do not cause serious burns, if used safely. Glue guns must be turned off when not in use. Run glue-covered fingers under cold tap and send to Medical, if burn occurs.</p> <p>Show slides: <a href="#">L3 Experimenting with Cams</a>  Show slides/video: <a href="#">L4 Finishing Touches</a> and <a href="#">Cam Mechanisms Miss M</a> - to show enthuse chn to not just have an item of interest placed on the top of the follower but to also 'create a scene' on the box - make the product aesthetically appealing.  Ensure you have a ready supply of glue gun sticks for this lesson. Glue guns used only to secure cams, followers, follower bases and drilled box frames.  Classroom glue stickers should be used for all other uses.</p> <p>Encourage children to work neatly (joins and cutting shapes) so that the final product is of a high aesthetic quality  <b>Q:</b> Would you buy this? <b>Q:</b> How can you make this product attractive so that someone will want to buy it?</p> <p><b>Take photos of final products, to be stuck in the next lesson so that Evaluation can be written alongside the photo.</b></p>
<b>Key Vocabulary for the lesson</b>	Automama, cam, follower, follower base, dowel, final product, aesthetic appeal, axel
<b>Curriculum Links</b>	History

**Resources**

Sketchbook (design sheet), glue guns, glue gun sticks, scissors, tape, assorted decorating materials, colouring pencils, glue sticks

## Lesson 7

**Kapow Lesson**

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**Learning Intention**

To **evaluate** my final design: its effectiveness and meeting design criteria.

**SOLO SC: Uni- Structural***Bronze*

I can **find** and fix small design flaws.

**SOLO SC: Multi- Structural***Silver*

I can **complete** my product

**SOLO SC: Relational***Gold*

I can **evaluate** my final design: its effectiveness and meeting design criteria.

**SOLO SC: Extended Abstract***Platinum*

I can **theorise** how I could improve my design if I were to build it again.

**Activity**

(What will the children do to demonstrate their understanding of the LI?)

**VICTORIAN DRAGON'S DEN (Teachers can dress up if they want!)**

**Chn will finalise their products ready for presentation and evaluation. Chn will evaluate finished products against the design criteria and original specification.**

**Chn will conduct a 'crit' (positive comments and suggest design improvements about their peers' work; discuss and analyse their product, considering comments from others and will suggest changes and amendments to design, to further the design's effectiveness in the future.**

**Stick in photos of the final product, taken at the end of the last lesson. Chn will be writing alongside this in sketchbooks.**

Allow time for design teams to tweak / fix products before presenting at the critique. (Dragon's Den)

Teams will present to each other, each group taking a turn at critiquing.

Positive comment and suggestion of improvement.

Chn can make annotations on their original design - does it meet all design criteria; improvements, etc

Chn to independently write a product evaluation, explaining what difficulties they faced during the task and how they overcame these; explaining how their design meets / did not meet the design criteria; and make suggestions about what changes need to be made so that the design meets these.

Display photos / finished products and photocopied of sketchbooks.

All products to be celebrated and can be taken home (unless being used for display).

	Children to consider the Think! Questions - class discussion and then write individual ideas, in sketchbook.
<b>Key Vocabulary for the lesson</b>	Automama, cam, follower, follower base, dowel, final product, aesthetic appeal, design criteria, modifications, evaluation, function, purpose, development, improvements.
<b>Curriculum Links</b>	History
<b>Resources</b>	Sketchbooks, finished automata, masking tape / Sellotape, glue guns and glue, Think! question.

## Lesson 7

<b>Assessment Think! Question</b>	<b>'If designing this product for someone visually impaired, what modifications would be required so that the automaton would still entertain?.'</b>
<b>Tasks</b>	See lesson outline above.
<b>Key Vocabulary for the lesson</b>	Automama, cam, follower, follower base, dowel, final product, aesthetic appeal, design criteria, modifications, evaluation, function, purpose, development, improvements.
<b>Curriculum Links</b>	History / PSHE
<b>Resources</b>	Sketchbooks, finished automata, masking tape / Sellotape, glue guns and glue.