

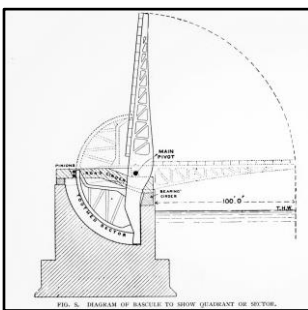
Year 4 Design and Technology: Mechanisms – Block B

How many ways are there to open a door?

- The outline and structure of the block is as follows:

Lesson 1	Lesson 2	Lesson 3
Exploring types of hinges	Developing practical skills	Developing practical skills
Developing practical skills	Evaluating outcomes	Evaluating outcomes

At the end of this block, pupils will ...	
Know:	Be able to:
Types of hinges and the related terminology	Make a variety of model hinges
Common uses for hinges	Make and evaluate hinged products using modelling materials



London's *Tower Bridge* uses huge hinges to lift up the road to allow boats to pass on the Thames.

In this block, pupils will investigate how hinges work. They will then select a range of modelling materials and tools to make their own hinged products, evaluating and modifying them throughout.

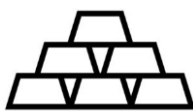
CUSP Design & Technology Long term sequence	Block A	Block B	Block C	Block D	Block E	Block F
Year 1	Mechanisms	Structures	Food and Nutrition	Understanding Materials	Textiles	Food and Nutrition
Year 2	Textiles	Food and Nutrition	Mechanisms	Understanding Materials	Food and Nutrition	Structures
Year 3	Textiles	Food and Nutrition	Mechanisms	Food and Nutrition	Systems	Structures
Year 4	Food and Nutrition	Mechanisms	Textiles	Structures	Electrical Systems	Food and Nutrition
Year 5	Food and Nutrition	Systems	Textiles	Mechanisms	Structures	Food and Nutrition
Year 6	Food and Nutrition	Mechanisms	Food and Nutrition	Structures	Electrical Systems	Textiles

Point of reference:

Y4 Mechanisms – Block B

Pupils will be able to:

- use cutting and joining techniques with a range of materials including card, plastic and wood



Prior Learning

- show an understanding of how to strengthen and stiffen structures
- identify and make simple mechanisms

Design or Technology History:

Although the use of hinges dates back thousands of years, it was during the early stages of the medieval times (500 – 700 AD) when the production of metal hinges similar to those used today really took off. Metalwork advanced during the medieval period and blacksmiths developed techniques to make durable but cheap wrought iron hinges. It became common for simple metal hinges to be used on doors in the homes of ordinary people, although the wealthy could afford more luxurious designs.

Links to Literature:

Hinges and Hinge-Based Catches by Charles Lewton-Brain (teacher resource)

Materials:

Variety of hinges, paper, paperclips, strips of wood, dowel, plastic, tubing, metal rod, metal wire, nuts and bolts, masking tape, sticky tape, double-sided tape, Blu-Tack ©, split pins, paperclips, decorative paper, cardboard (2-3mm thick), glue guns, glue sticks, cutting mats, craft knives, safety rulers, scissors, handsaws (junior hacksaw or tenon), bench hooks, wooden kebab skewers or 2mm metal rods, metal eyelets, strips of fabric

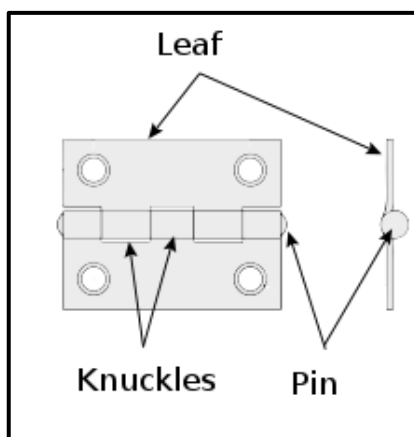
Health and Safety:

This block requires pupils to use scissors, craft knives, steel safety rulers and cutting mats to cut card and paper. Pupils will use handsaws and bench hooks to cut strips of wood and dowel. Glue guns will be used to connect modelling materials and sharp pencils used to pierce holes into cardboard. Teachers should ensure that they follow their own school's risk assessments and policies for using the necessary materials and equipment. Pupils should be taught about how to use equipment and materials safely and responsibly as part of these lessons.

Working as a Designer

Design	Make	Evaluate	Apply
The art or process of deciding how something will look or work.	Create something by combining materials or putting parts together.	Form an opinion of the value or quality of something after careful thought.	Use something or make something work in a particular situation.

Supporting images: Y4 Mechanisms – Block B



Point of explanation:

Y4 Mechanisms – Block B

Core Knowledge	Explanation
hinge	A hinge is a rotating joint that allows movement between two linked objects.
knuckle	The knuckle is the hollow circular part at the joint of a hinge through which a pin is passed. The knuckle is often called a loop, joint, node or curl.
leaf	The leaf is the portion of a hinge extending from the knuckle and which usually revolves around a pin.
pin	The pin is the rod running the length of the hinge. The pin holds the leaves of the hinge together.
barrel	The barrel is the part of a butt hinge where the knuckles are connected with a pin.





Technical Vocabulary	Definition
butt hinge	a hinge that consist of two rectangular leaves connected with a pin, with screw holes to attach the hinge to a surface
concealed hinge	a hinge that is completely hidden when the door or lid of a box is closed
net	a two-dimensional shape that can be folded to form a three-dimensional solid

Link to Video: <https://vimeo.com/671207063/3f22532574>

- Explanation and demonstration of taught content
- Lesson by lesson guidance
- Exemplification of techniques and outcomes

Point of delivery:

Y4 Mechanisms – Block B

Revisiting prior learning 	Taught content 	Point of practice 	Point of reflection 
<p>1. Identify simple mechanisms and their uses</p> <p>Simple mechanisms are those powered by hand</p> <p>The direction, speed and power of movement can be changed by using mechanisms</p>	<p>Identify the purpose of a hinge and know that it is a rotating joint that allows movement between two linked objects</p> <p>Explain the different features and applications of a variety of hinges</p> <p>Use a range of materials and simple tools to construct a variety of hinges and evaluate their effectiveness</p>	<p>Introduce pupils to the key question for this block: How many ways are there to open a door? Discuss with pupils the mechanism involved and show examples of some common hinges (physical and pictorial). Examples could include:</p> <ul style="list-style-type: none"> • butt hinge • concealed hinge • flush hinge • T hinge • butterfly hinge • barrel hinge <p>Discuss their features and applications. Challenge pupils to find and identify types of hinges used in the classroom. Can pupils suggest a suitable definition for the word hinge? With pupils, agree on a definition and display this for future reference. Introduce pupils to the Knowledge Note to reinforce the key vocabulary for this block.</p> <p>Through questioning and discussion, establish that hinges tend to be made from brass due to this metal's durability and ability to withstand abrasion. Emphasise to pupils the difference between hardness and strength.</p> <p>Using a disassembled butt hinge or a clear diagram, show pupils the composite parts and their function. Pupils can then draw a labelled diagram in their portfolios.</p> <p>Show pupils how to make a simple example of a butt hinge using cardboard and rolled paper (refer to teacher video).</p> <p>Demonstrate, using a craft knife and metal safety rule, how to measure and cut a rectangle from the centre of a piece of cardboard. Some pupils could be supplied with a template to scaffold this activity, whilst others may need this pre-prepared for them, in advance of the lesson. Pupils then attach their butt hinges and evaluate its effectiveness.</p> <p>Show pupils some further examples of how hinges could be made using a range of materials and methods. In pairs or groups, challenge pupils to make some more doors from cardboard and select methods and materials to make different types of hinges.</p> <p>Pupils make annotated drawings in their portfolios and evaluate the outcomes.</p>	<p>Can describe the features of specific hinges</p> <p>Can explain what a hinge is and give examples of where hinges are used</p> <p>Can label a simple diagram correctly using accurate technical vocabulary</p> <p>Can use accurate measuring and cutting skills</p> <p>Can follow a modelled process to make an example of a butt hinge</p> <p>Can experiment with alternative ways to add a hinge to a model</p> <p>Can explain what works well and make suggestions for improvements</p>

Questions for assessment

Why are most hinges made from brass?

What properties does brass have that make it a suitable metal for making hinges from?

How many different types of hinges can you find?

What is the difference between a concealed hinge and a butt hinge?

How is a butterfly hinge different from a butt hinge?





What are the common uses of a concealed hinge?

Which hinge was most effective?

What changes would you make to ensure the door opens and closes without snagging?

Point of delivery:

Y4 Mechanisms – Block B

Revisiting prior learning 	Taught content 	Point of practice 	Point of reflection 
<p>2. A hinge is a rotating joint that allows movement between two linked objects</p> <p>There are different types of hinges that have differing features and applications</p>	<p>Use measuring, cutting and joining skills to construct a gift box from cardboard</p> <p>Design and make a product that incorporates a working hinge</p> <p>Make decisions about the most appropriate hinge to be incorporated and give reasons for choice</p> <p>Evaluate outcomes, making judgements about aesthetics, accuracy and stability and effectiveness of the hinge</p>	<p>Some pre-cut rectangles will need to be made prior to the lesson for those pupils who may struggle to measure, draw and cut the rectangles required to form the net of a box.</p> <p>Challenge pupils to see if they can recall some of the types of hinges and relevant technical vocabulary they were introduced to in the previous lesson. Revisit the key vocabulary using the Knowledge Note.</p> <p>Explain to pupils that, in this lesson, they will make a gift box to incorporate a hinge of their choice. Show pupils a completed example but emphasise that they should decide and make a type of hinge that they think would be most suitable in this context.</p> <p>Demonstrate to pupils how to make a rectangular box from composite parts of its net. Show pupils how these can be covered with decorative paper prior to construction (refer to teacher video). Using the same methods, pupils make a lid, ensuring that it is slightly larger than the box.</p> <p>Prompt pupils to refer to the hinges they experimented with in the previous lesson and challenge them to make a suitable hinge for their gift box. Use questioning to elicit pupils' views and ideas about which type of hinge would be suitable and why.</p> <p>Take photographs throughout so that pupils have a record of the processes which they can add to their portfolios. Prompt pupils to evaluate their gift boxes in terms of stability, accuracy, aesthetics and the effectiveness of their chosen hinge.</p> <p>Finally, pupils complete Vocabulary Task 1.</p>	<p>Can use basic tools to cut and measure materials accurately</p> <p>Can make secure joins when constructing a box and lid from a net</p> <p>Can make reasoned decisions about which type of hinge to incorporate into their gift box</p> <p>Can follow a modelled process to make a specific type of hinge</p> <p>Can make judgements about the aesthetics of their completed box and suggest improvements</p> <p>Can make evaluative comments about the effectiveness of their hinge</p>

Questions for assessment

What do you need to do to make sure the net of your box fits together correctly?

Why does the lid need to be slightly bigger than the box?

How can you strengthen the joins?





Which types of hinge would be most suitable for the gift box?

What would the advantages and disadvantages be of using a butt hinge?

How effective was your choice of hinge?

Point of delivery:

Y4 Mechanisms – Block B

Revisiting prior learning 	Taught content 	Point of practice 	Point of reflection 
<p>3. Use basic tools to cut and measure materials accurately</p> <p>Design and make a product that incorporates a working hinge</p>	<p>Apply knowledge of how to make a hinge to fulfil a specific brief</p> <p>Use modelling skills to construct a stable product</p> <p>Modify the design as necessary</p> <p>Evaluate outcomes</p>	<p>Refer pupils to the key question for this block: How many ways are there to open a door? Explain to pupils that they will apply the skills and knowledge they have acquired in the previous lessons to design and construct a product based on the concept of an advent calendar.</p> <p>Recap the range of hinges pupils made in the first lesson and explain that they will need to decide on an appropriate hinge to make and use in their product.</p> <p>Show some examples of the kinds of products that could be made, such as a 'countdown' to a birthday or special event or a calendar that displays the days of the week.</p> <p>Remind pupils that their product will need to have multiple doors so accuracy of measuring and cutting will be important. Pupils may wish to use a range of different hinges in their product or select one.</p> <p>Pupils draw annotated designs in their portfolios, writing notes about the reasons for their choice of product and explanations of how the product, including the hinges, will be made.</p> <p>Encourage pupils to evaluate their designs as they construct the product and make changes and modifications as necessary.</p> <p>Once constructed, pupils use Vocabulary Task 2 to guide their evaluations.</p>	<p>Can apply prior learning to a different context</p> <p>Can demonstrate accurate measuring, drawing and cutting skills</p> <p>Can identify weaknesses and strengths of a product and suggest modifications</p>

Questions for assessment

Which type of hinge did you choose to make and **why**?

Did you make the right choice for this specific product?

Do the hinges on your product allow for the doors to open smoothly?

Do the doors on your product stay open? Are adjustments needed?

How could the stability of your product be improved?

What other materials might have been suitable for making this product?

How could you improve the overall appearance of your product?

Oracy and Vocabulary: Y4 Mechanisms – Block B

Task 1:

You have learnt that a *hinge* is a **rotating** joint that allows movement between two **linked** objects.

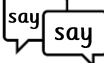
Make a list of synonyms for the word **rotating**.

Synonyms for *rotating*

Next ...

Make a list of synonyms for the word **linked**.

Synonyms for *linked*









Exploration: 

Here is the start of a list of objects that use hinges:


cupboard doors, box lids, ...


What objects could you add to this list?


Task 2:


How do you feel about this task?  	What did you find easy?	
	What did you find difficult about the task?	
	What would have made the task easier?	
Do the doors on your product open easily and stay open? How could you improve this part of your product?		
Is your product stable? How could you improve its stability?		
Are you satisfied with the appearance of your product? How could this be improved?		

Vocabulary: Y4 Mechanisms – Block B

OWN-it	Analyse 
Tick the correct word class for the word <i>hinged</i> .	
<input type="checkbox"/> verb <input type="checkbox"/> adjective <input type="checkbox"/> noun	
Write the <u>present</u> tense <u>opposite</u> of this word.	
concealed - _____	
Change this word from an adjective to a verb.	
rotational - _____	

KNOW-it	Define 						
Tick true or false.							
A <i>hinge</i> is used to strengthen a join.							
<input type="text" value="true"/> <input type="text" value="false"/>							
Tick the part of a <i>butt hinge</i> that matches this description:							
<ul style="list-style-type: none">the rod running the length of the hinge							
<table border="1"><tr><td>leaf</td><td></td><td>pin</td><td></td><td>knuckle</td><td></td></tr></table>		leaf		pin		knuckle	
leaf		pin		knuckle			
Explain what a <i>net</i> is.							
<div style="border: 1px solid black; height: 80px;"></div>							

LINK-it	Connect 
Circle the word that is the odd one out.	
hinge lever rotate	
Write two words that are antonyms of the word <i>concealed</i> .	
<div style="border: 1px solid black; height: 40px; width: 100%;"></div> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	
Tick the synonyms of the word <i>rotate</i> .	
<input type="checkbox"/> spin <input type="checkbox"/> swerve <input type="checkbox"/> pivot	

USE-it	Use in context 
Tick the box if the word <i>concealed</i> has been used correctly in this sentence.	
If the snake is <i>concealed</i> by the surrounding bushes, it may be easy to spot.	
<input type="checkbox"/>	
Write a sentence that includes these words: net dimensional	
<div style="border-bottom: 1px solid black; height: 20px; width: 100%;"></div> <div style="border-bottom: 1px solid black; height: 20px; width: 100%;"></div>	
Use the word <i>barrel</i> in a sentence.	
<div style="border-bottom: 1px solid black; height: 20px; width: 100%;"></div> <div style="border-bottom: 1px solid black; height: 20px; width: 100%;"></div>	

Knowledge Note:

Y4 Mechanisms – Block B

Year 4: Mechanisms

How many ways are there to open a door?



Core content:

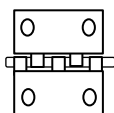
Investigate how hinges work.
Select a range of modelling materials and tools.
Make and evaluate hinged products.

Technical vocabulary:

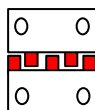
Hinge – a rotating joint that allows movement between two linked objects.



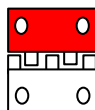
Butt hinge – a hinge that consist of two rectangular leaves connected with a pin, with screw holes to attach the hinge to a surface.



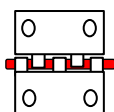
Knuckles – the hollow circular parts at the joint of a hinge through which a pin is passed. The knuckle is often called a loop, joint, node or curl.



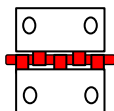
Leaf – the portion of a hinge extending from the knuckle which usually revolves around a pin.



Pin – the rod running the length of the hinge. The pin holds the leaves of the hinge together.



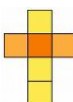
Barrel – the part of a butt hinge where the knuckles are connected with a pin.



Concealed hinge – a hinge that is completely hidden when the door or lid of a box is closed.



Net – a two-dimensional shape that can be folded to form a three-dimensional solid.



Connections:

London's *Tower Bridge* uses huge hinges to lift up the road to allow boats to pass on the Thames.



Year 4: Mechanisms

How many ways are there to open a door?



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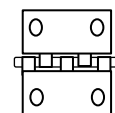
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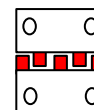
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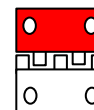
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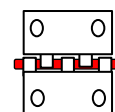
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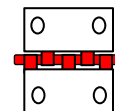
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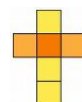
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Connections:

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Exemplification: Y4 Mechanisms – Block B

How many ways are there to open a door?

Definition:

A hinge is a rotating joint that allows movement between two linked objects.

But hinges are often used to 'hang' doors in buildings.

Concealed hinges cannot be seen and have a mechanism built in that keeps doors firmly shut.

Butterfly hinges are decorative and are often used for jewellery boxes.

Flush hinges close very flat and are simple to attach.

This is my barrel hinge. It opened and closed the smoothest out of all my hinges.

I made 2 circular clips from a paper clip. They needed to be bigger and I should have had a bigger gap.

My barrel hinge worked very well, although next time I will make each leaf a bit smaller.

Challenge pupils to identify different types of hinges and uses of them in real life

Ask pupils to name the different parts of a hinge

Pose questions to pupils:

What is a hinge?

Where are hinges used?

What types of hinges can you name?

What materials are hinges made from?

What type of motion is involved with hinges?

Which hinges are easier / harder to attach?

Pupils experiment by making a variety of model hinges to enable cardboard doors to open and close

Provide plenty of opportunities for pupils to evaluate their hinges

Pose questions to pupils:

What type of real-life hinge is the model hinge based on?

Does the door snag?

How could the design of the handles be improved?

Exemplification: Y4 Mechanisms – Block B

How many ways are there to open a door?

Pupils make a gift box that incorporates a model hinge

Pose questions to pupils:

How accurately has the box been made?

How strong are the joints?

How could you have designed and attached a catch?

Could you have used a more attractive material?

Allow students to experiment by making an advent calendar-themed product

Pupils evaluate the success of their product

Pose questions to pupils:

How could you have improved the aesthetics?

How can the product be made stronger?

How well balanced is the product?

What production method would you use if you needed to make a hundred or a thousand of these?

How could you improve the shape?

How could you incorporate electronics into the design?

Could you have incorporated lights or sound?

GIFT BOX

'COUNTDOWN' PRODUCT

Improvements

- Fraying edges - The double-sided tape does not stick the tabs down securely enough so I would use the glue gun to stick them next time.
- No handle - I think by adding a handle it would make the design better and more interesting.
- Unattractive - The inside of the box looks ugly. I could decorate this or add a felt inlay.

Improvements

- Shape - I am not totally happy with the rectangular shape. It is a bit basic so I would rather have had designed it as a hexagon, with triangular doors.
- Handles - The wooden handles look a bit chunky. I should have used small, brass handles.
- Door numbers - I should have labelled each door with a number - 1-6.