

Lesson 1



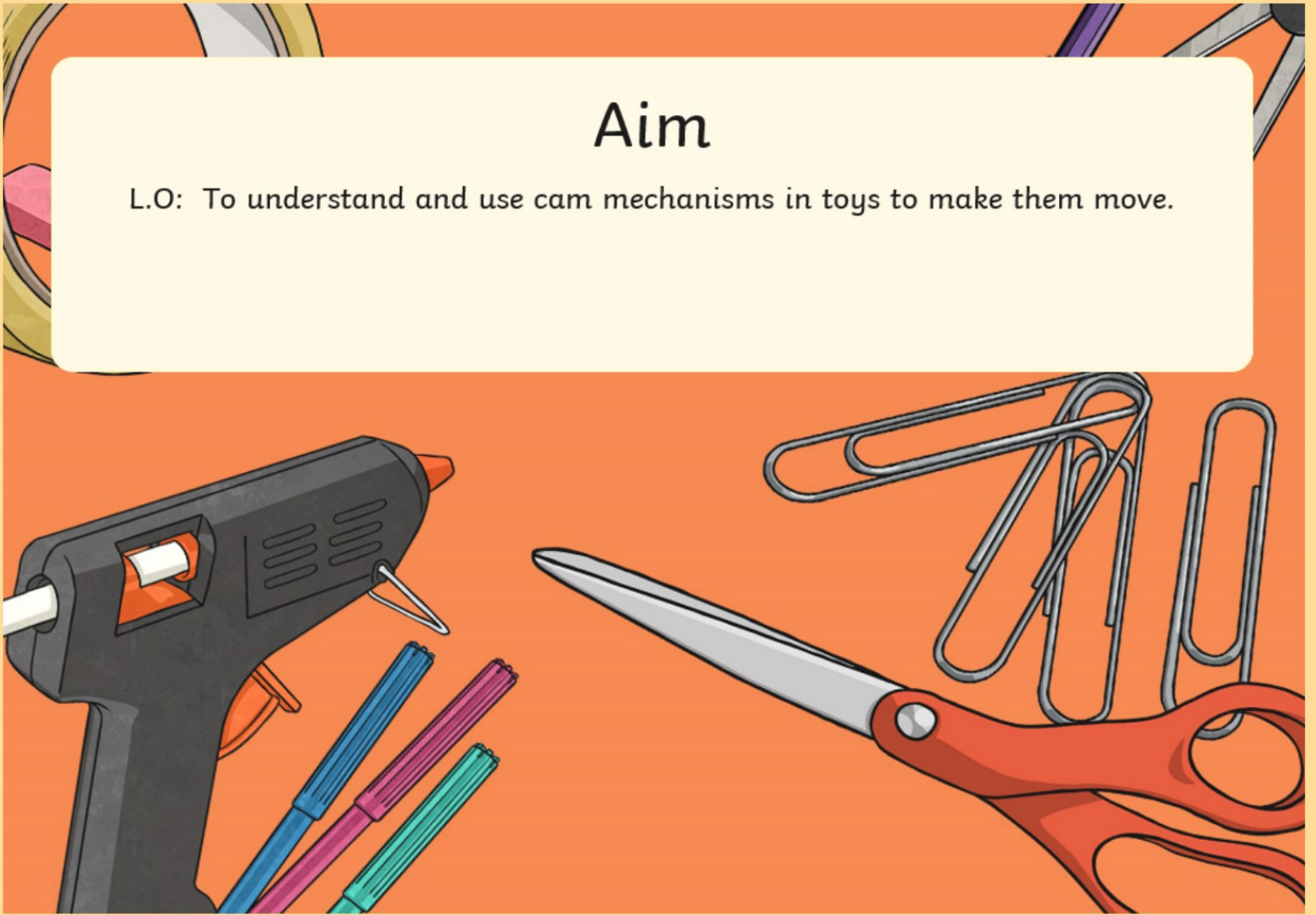
Design and Technology

Technical Knowledge - cam mechanisms



Aim

L.O: To understand and use cam mechanisms in toys to make them move.





Y3 We Are Engineers: Cams Easter Card — Knowledge Organiser



Key Knowledge

Learn this information

The 4 main components that are used to construct a working cam mechanism:

- Cam
- Shaft
- Follower
- Slide



Cams come in various shapes, these are called cam profiles: Round, pear/egg, eccentric, hexagon, oval and snail.



The shape of the cam controls the movement of the follower.

If the pivot point is not central, the movement will be greater.

The peak is the part of the cam that is the furthest from the pivot point, creating a large movement.

The snail causes a sudden drop as the follower falls from the peak to a part of the cam that is close to the pivot point.

Problem solving is important if you want your cam mechanism to function correctly.

Common errors to avoid:

- Fixing the slide too low down so the cam peak hits it as it rotates.
- Cutting the follower too short.
- Punching the hole in the card too low.

Key Skills

Practise and perform these skills

Sketch and annotate a cam mechanism using the correct components and vocabulary.

- 1) Punch a hole safely by placing the card on top of a cluster of blu tack and then using a sharp pencil, push a hole through both the card and the blu tack. Make sure the hole is not too low - you don't want the cam to hang lower than the card as your card will not be able to stand up.



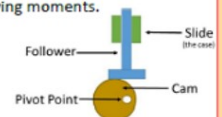
- 2) You can then push the shaft through the hole and attach two cams to the shaft - place a round cam on the front of the card, and the cam profile of your choice on the inside of the card. Both cams should move together now when one is rotated.
- 3) Once your cams are attached to the shaft, secure the slide above the cam profile inside the card with masking tape - ensure there is enough room for the whole cam to rotate, the peak should not clash with the slide!
- 4) After this you can put the follower into the slide, it should be long enough to fall down to the cam but be long enough to reveal your 'toy' on top of the slide when it moves in a linear movement.
- 5) Rotate the round cam on the front of the card to move the cam mechanism, if it has a second hole, you can attach a dowel as a handle.



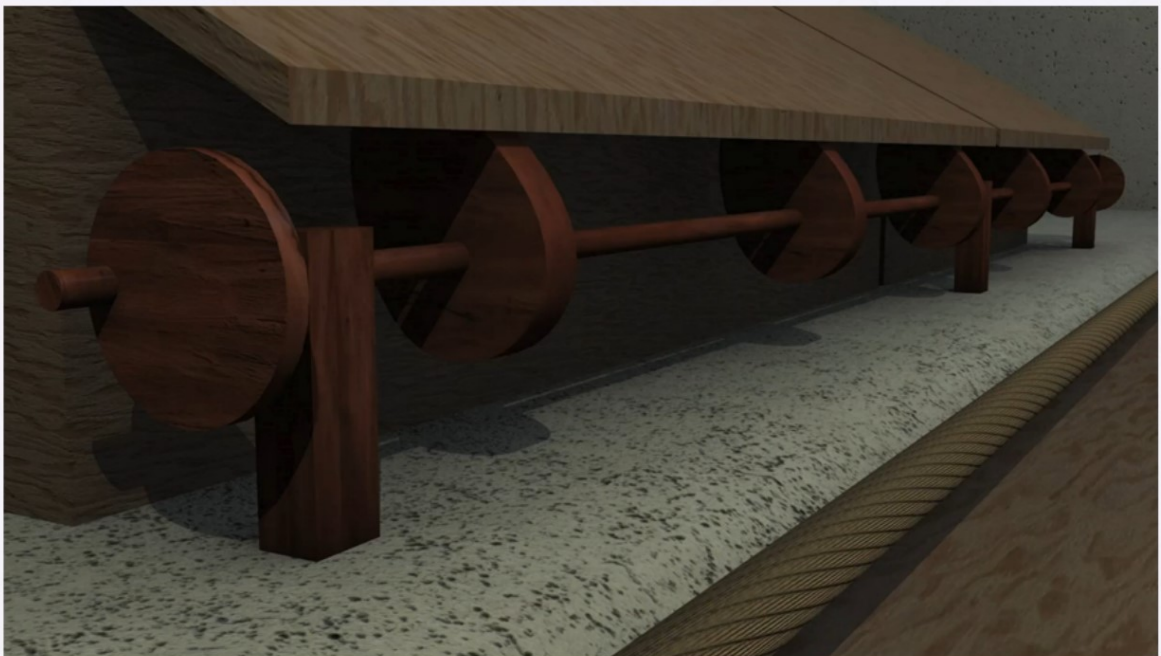
Key Vocabulary

Understand these key words

Word	Definition
Cam	A cam is a wheel (in various shapes) attached to a shaft.
Shaft	The rotating shaft the cam and handle are joined to.
Follower	A bar that touches the cam and follows the shape, moving up and down (around its circumference).
Slide	A secure compartment that guides the follower and keeps it in place.
Mechanism	Parts that work together in a machine.
Component	A part of something.
Linear	Up and down movement.
Handle	The part of an object made to be held in order to lift, move (rotate), or hold the object.
Rotate	To turn on or around a fixed point.
Prototype	An original model on which later forms can be made based on improvements and developments.
Pivot point	A point around which something can rotate or turn. The fulcrum, the hole in the cam where the shaft is attached.
Peak	The highest point of the cam (furthest distance from fulcrum).
Drop	When the follower falls, this can be sudden or gradual depending on which shape cam is used.
Dowel	A dowel is a cylindrical rod, usually made from wood, plastic, or metal.
Fulcrum	The pivot point in a system involving moments.



Starter Activity



How is this wooden toy moving?
How many parts does it have? How are the parts joined?



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Components

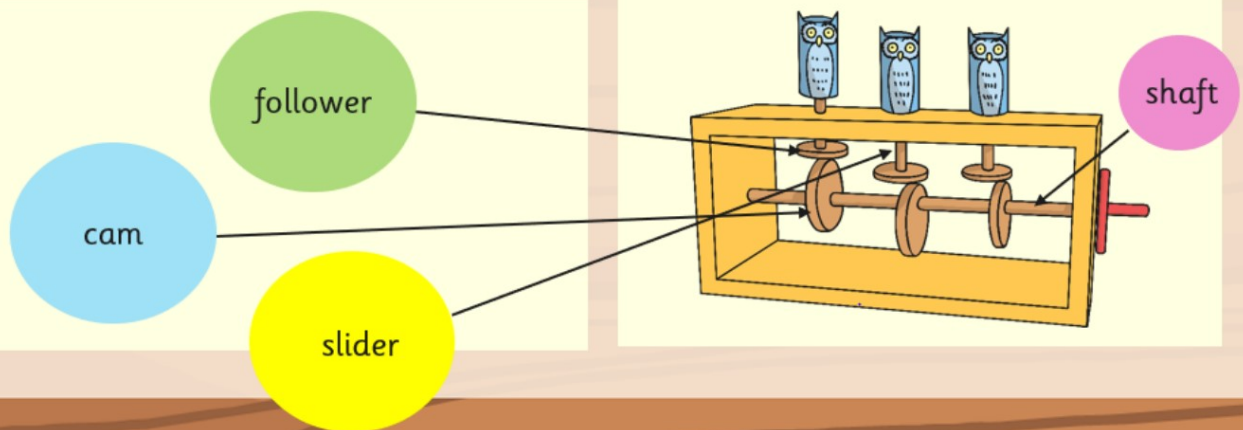
A cam mechanism is made up of three main components - a cam, a follower and a slider.

Cam – A wheel attached to a shaft. A rotating disk shaped to convert rotary into linear motion.

The **mechanism** causes **components** to move either in a **linear** motion (a straight line) or a **rotary** motion (goes round) .

Follower – A bar that touches the cam and follows the shape, moving up and down (around its circumference).

Slider – A secure compartment that guides the follower and keeps it in place.



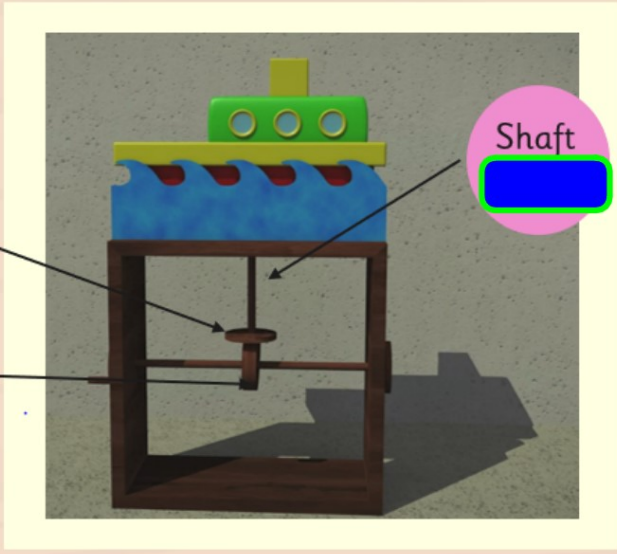
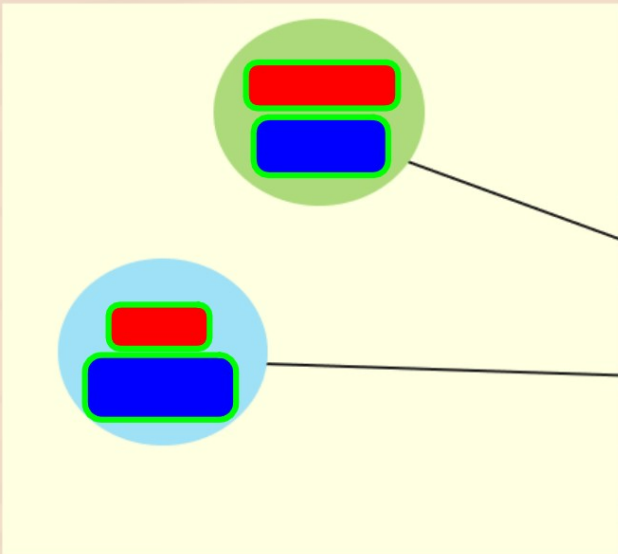
Components

Can you identify the cam?

Can you identify the follower?

Where is the rotary motion used?

Where is the linear motion used?



Answers

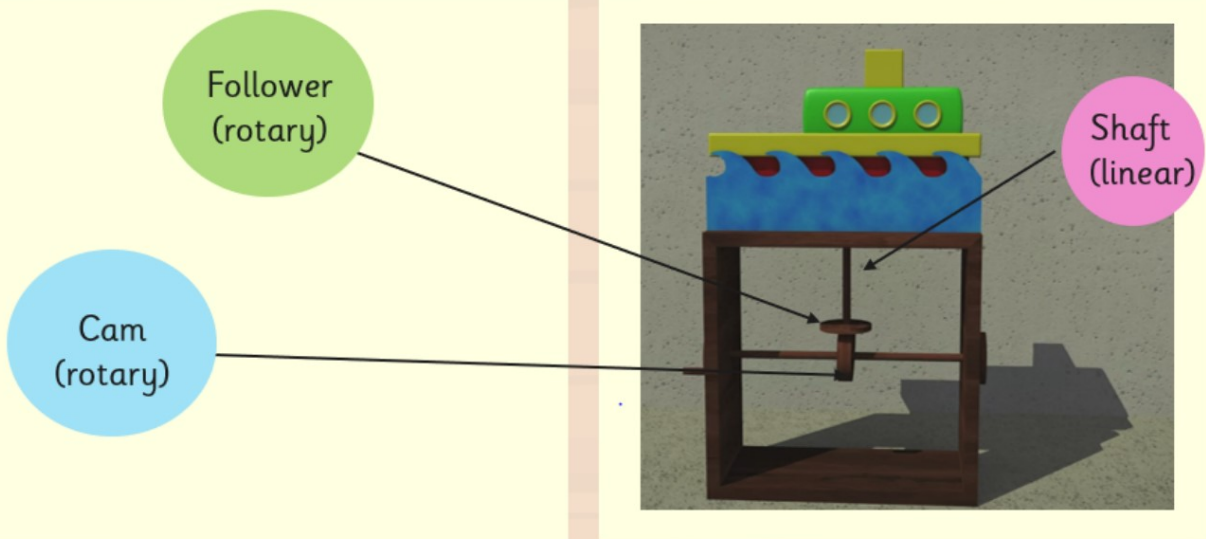
Components

Can you identify the cam?

Can you identify the follower?

Where is the rotary motion used?

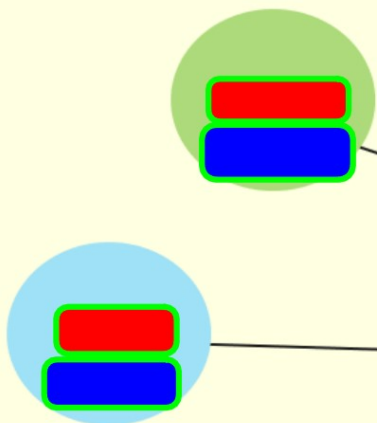
Where is the linear motion used?



Components

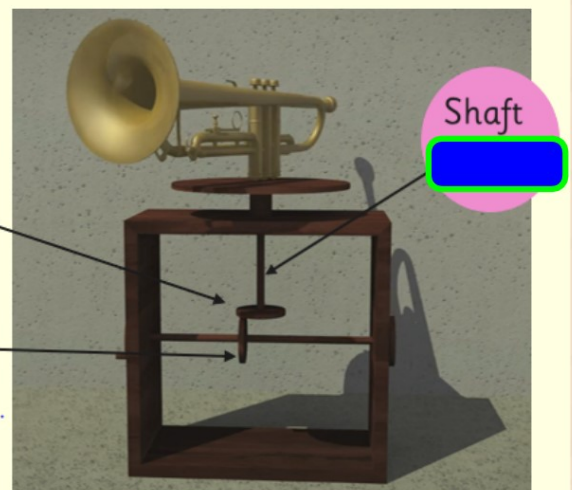
Can you identify the cam?

Where is the rotary motion used?



Can you identify the follower?

Where is the linear motion used?



Answers

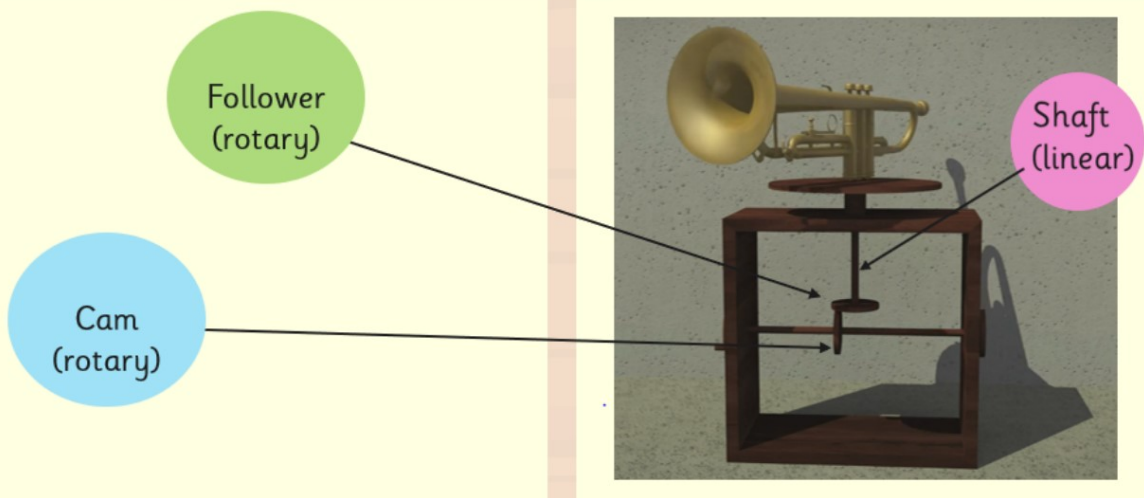
Components

Can you identify the cam?

Can you identify the follower?

Where is the rotary motion used?

Where is the linear motion used?



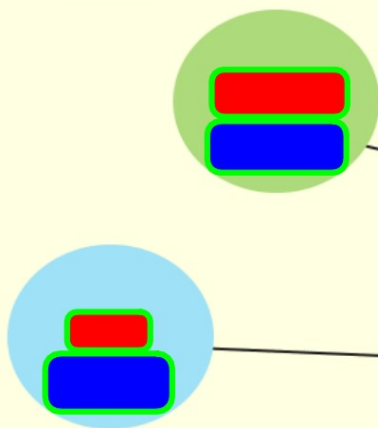
Components

Can you identify the cam?

Can you identify the follower?

Where is the rotary motion used?

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Answers

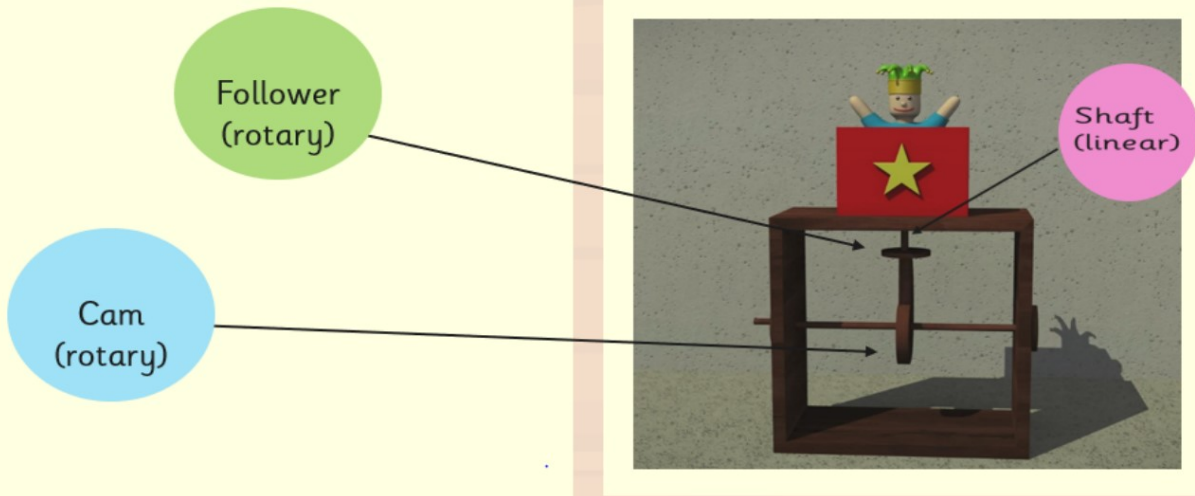
Components

Can you identify the cam?

Can you identify the follower?

Where is the rotary motion used?

Where is the linear motion used?



Did you know?

Making Moving Toys

There are different types of cams which create different movements.



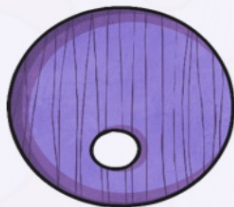
round



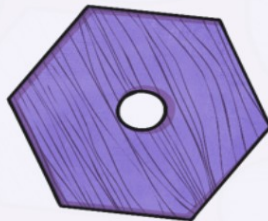
egg-shaped



ellipse



eccentric



hexagon



snail

What Have We Learnt?



Cam Mechanisms

Aim: I can explain how simple cam mechanisms work.



What is a cam?

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What is a follower?

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Draw and label three cam mechanisms seen in the clip.

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How does a cam mechanism help something move up and down?

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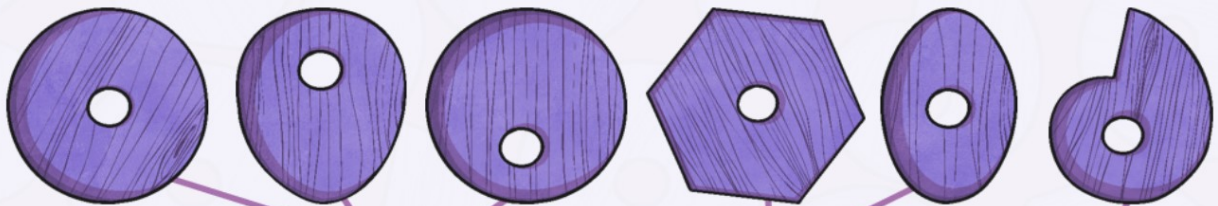
Any other findings.

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Can you name them?

Making Moving Toys

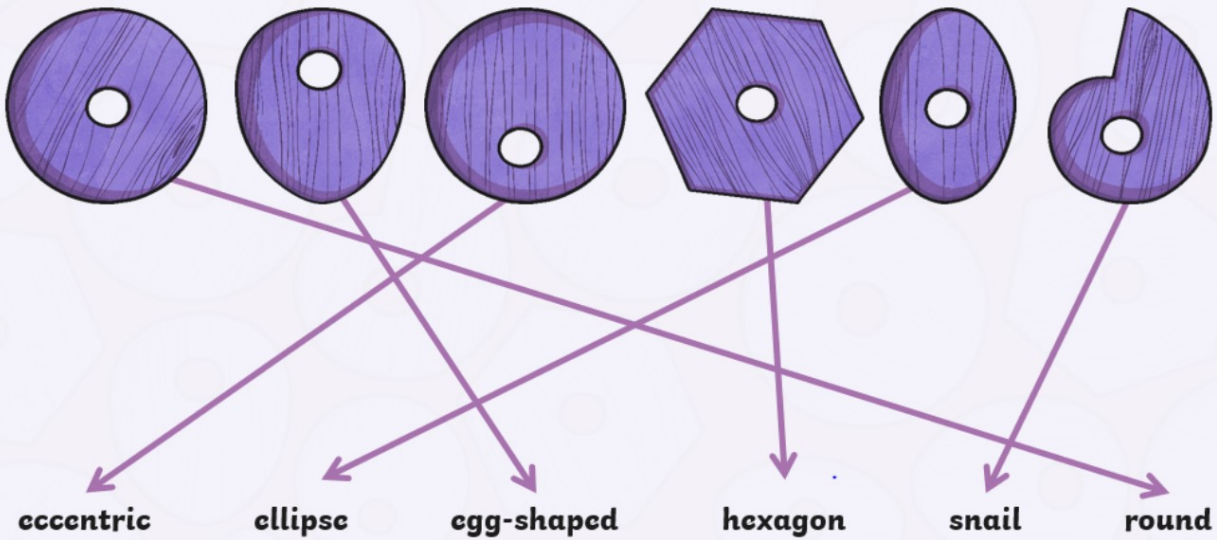
Match up the cams to their names.



Answers

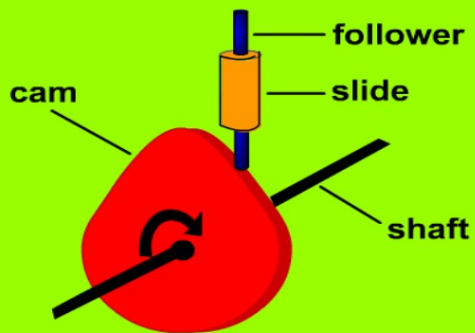
Making Moving Toys

Match up the cams to their names.



Cam Mechanisms

The cam device consists of 4 main parts:



When the **shaft** turns, the **cam** rotates. The **follower** rests on the cam following its **profile**. The **slide** supports the follower, allowing it to move freely in a **reciprocating** motion.

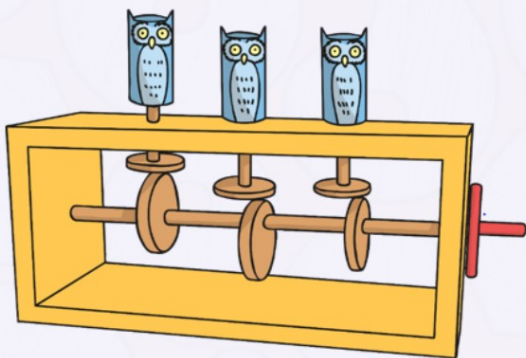
Look through different cams



Activity

How might it move?

How would the owls move if we replaced the eccentric cams for another?
Can you draw the movement?



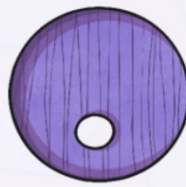
round



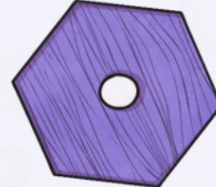
egg-shaped



ellipse



eccentric



hexagon

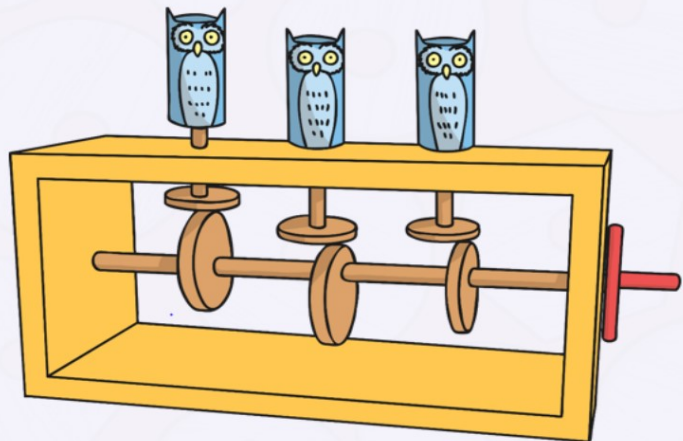


snail

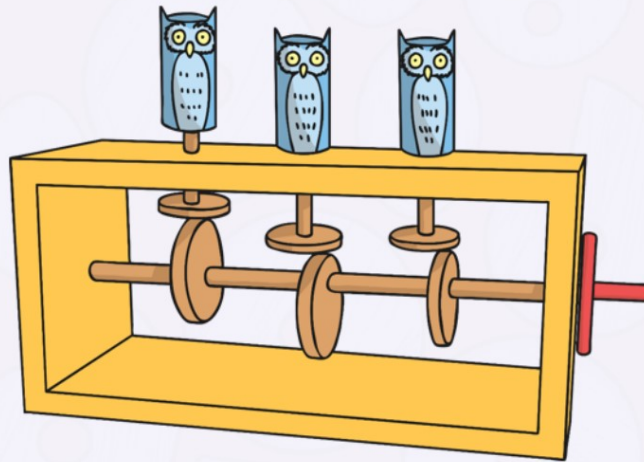
Different Types of Movement

Linear movement – moving in a straight line, up or down
Rotary movement – turning around in circle, like a wheel turning

- How will the owls move?
- How will the cams move?
- How will the followers move?



Linear or Rotary?



- **The eccentric cam** – this rotates as it fixed to the axle which is turned by the handle.
- **The follower cam** – the eccentric cam causes the follower to move up and down (linear) and rotate.
- **The owls** – they have linear and rotary movement caused by the eccentric cams and followers.

Cam Design Challenge

The task - Design a moving toy aimed at Upper Primary, with between 6 and 8 cam mechanisms. Each cam can be different or the same, or you can choose a mixture. Design the front and back of the toy and show movement.

Front

Back

