

Acknowledgements

While the authors get their names on the cover of books and workbooks, a book isn't the result of the efforts of only the authors - it's a team effort by a lot of talented people. Please take a moment to look at our acknowledgements to see a list of the great people who all made important contributions to this series of workbooks.

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Book 4 - Copyright Agreement

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World Structures

- Work with a partner and do some research to see if you can find out the following :
List your findings here.

Tallest Man-Made Structure

In the world

Country = _____

Height =

Picture =

In South Africa

Height =

Picture =



A



B

Tallest Building

In the world

Country = _____

Height =

Picture =

In South Africa

Height =

Picture =



C

Tallest LEGO Tower

In the world

Country = _____

Height =

Picture =

No of bricks =



E



D

The only limit to your imagination ... is the power of your mind !

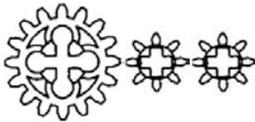
Working out ratios

○ Now, see if you can work out some of these gear ratios.

○ First, **estimate** how many times it should be.

(Write it in pencil under the follower)

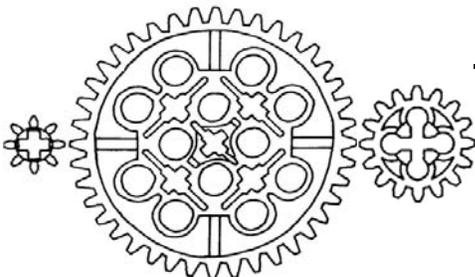
Number 1 :



$$\frac{\text{no. of teeth on follower } \square}{\text{no. of teeth on driver } \square}$$

Gearing :

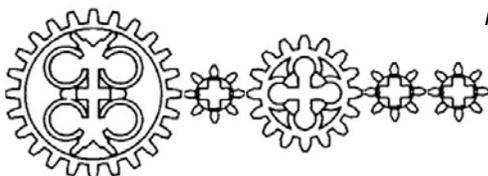
Number 2 :



$$\frac{\text{no. of teeth on follower } \square}{\text{no. of teeth on driver } \square}$$

Gearing :

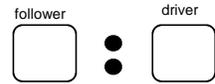
Number 3 :



$$\frac{\text{no. of teeth on follower } \square}{\text{no. of teeth on driver } \square}$$

Gearing :

The mathematical and scientific way of writing a ratio.



or



or



or



▀ Did the idler gears make any difference to the gear ratios ?

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Cams

Another mechanism that can be used to change one type of motion into another is a cam.

It is a wheel and axle, but on a cam wheel either

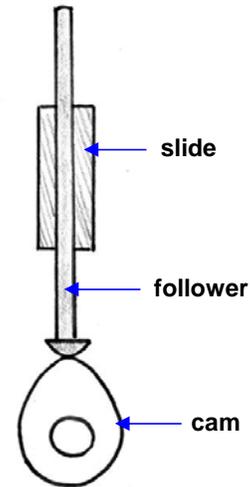
- the axle is not in the centre or
- the cam (wheel) is not round.

○ This mechanism has three parts :

cam - shaped piece of metal or plastic fixed to a rotating shaft

follower - a rod that rests on the edge of the rotating cam

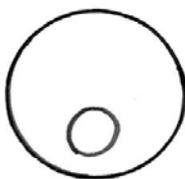
slide - a guide to stop the follower from moving from side to side



○ These three parts ensure that the follower can only do three things.

- 1 Rise (move up)
- 2 Fall (move down)
- 3 Dwell (remain stationary)

The follower's pattern of movement depends on the shape (outside edge) of the cam that it follows.



Eccentric



Drop Cam



Pear Shaped



Square



Heart Shaped

○ The shape can affect :

- how often the follower moves
- how quickly the follower moves
- the pattern in which the follower moves

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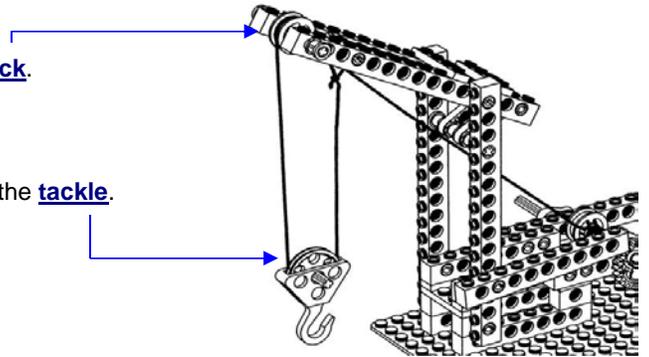
Block & Tackle

You have seen in models C8, C9 & C10 that if a load is too heavy to lift with a single pulley, a different system of connected pulleys can be used.

The top pulley is fixed and is called the **block**.

The second pulley can move and is called the **tackle**.

A pulley system like this is called a compound pulley or **block and tackle**.

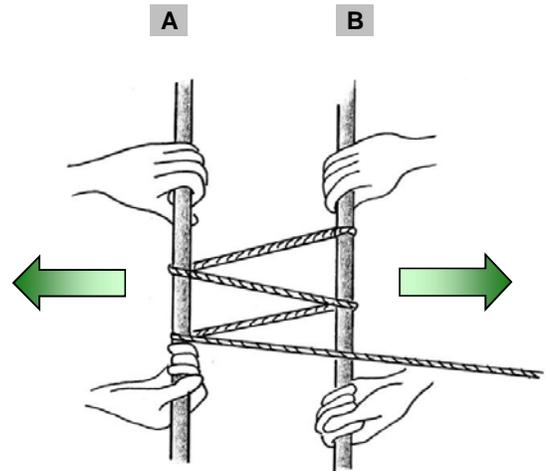


BUILD & EXPLORE

- Try this exercise that demonstrates the power of multiple moveable pulleys. Work in groups of three. Allow each person to be A, B and C once.

You need : two (broom) sticks or dowel rods
rope, thick string or cable

- Tie the rope around one of the poles.
- Two members of the group each take a pole and hold them parallel to each other. (About half a metre apart)
- Wrap the rope back and forth between the poles two times.
- Now, whilst the two members holding the poles try to pull them away from each other, the third member pulls on the loose end of the rope.



Who controls the distance ? A B C

- Wrap the rope back and forth another four times, and try the exercise again.

Is there a difference ? Y N

Who controls the distance ? A B C

- Try another four times, and re-test.

Is there a difference ? Y N

Who controls the distance ? A B C

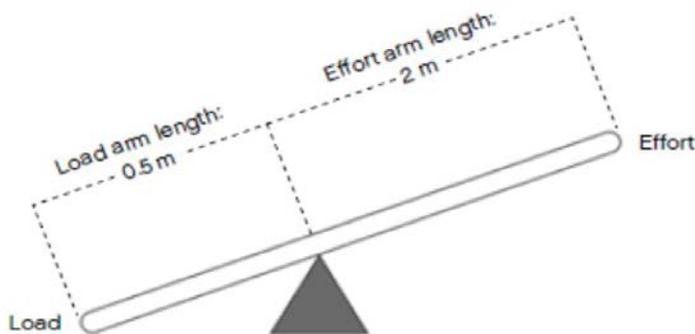
The only limit to your imagination ... is the power of your mind !

Mechanical advantage of a lever

The mechanical advantage of a lever is the ratio of the length of the effort arm to the length of the load arm.

It can be calculated using the following formula :

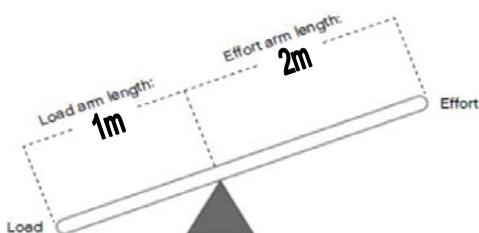
$$\text{Mechanical advantage} = \frac{\text{Length of effort arm}}{\text{Length of load arm}}$$



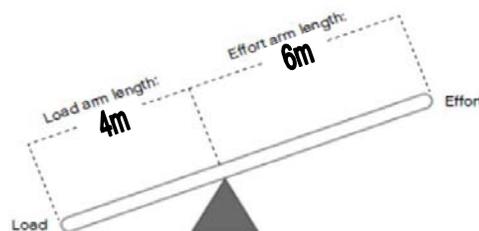
The mechanical advantage of this 1st class lever is :

$$\frac{2\text{m}}{0.5\text{m}} = 4$$

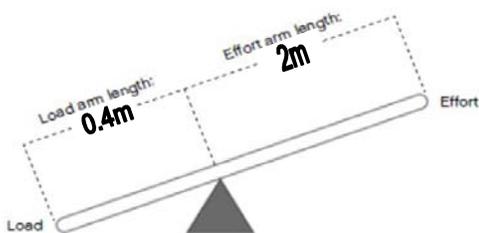
Work out the mechanical advantage of the following 1st class levers.



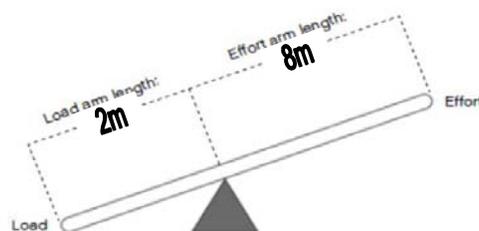
Mechanical advantage =



Mechanical advantage =



Mechanical advantage =



Mechanical advantage =

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