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MOBILE REVISION

GEARS AND PULLEY SYSTEMS

This mobile revision pdf is based on detailed work found in the 'GEARS AND PULLEYS' section.

Tap on the green link button below to go to the complete website section

Tap the blue button to view GEARS AND PULLEYS covered by this Revision PDF

GEARS AND PULLEY SYSTEMS

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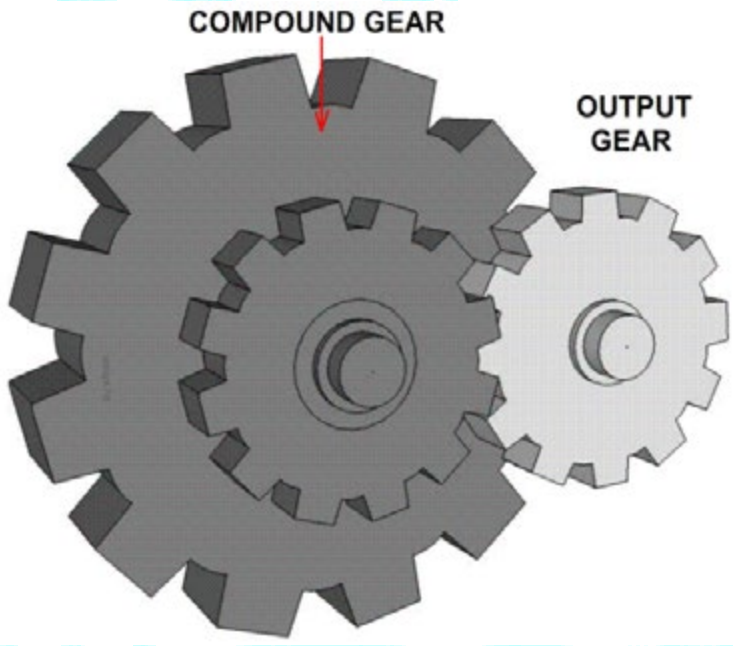
SPUR GEARS AND SIMPLE GEAR TRAINS

Gears can be found in many machines in a workshop or factory and at home. They are often an important part of mechanical devices. In a car, the gears help the driver to increase and decrease speed as he/she changes the gears with the gear stick.

Tap the image for more information and examples



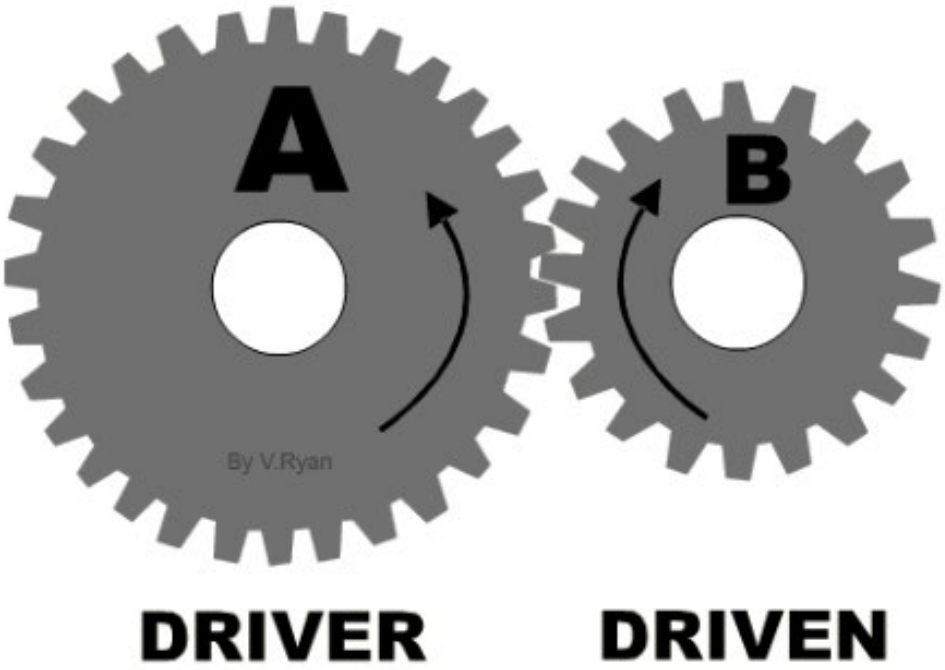
Tap the blue button for the next Gears / Pulley page.

Tap the red button to return to the Contents page

SPUR GEARS AND SIMPLE GEAR TRAINS

The gears shown below are called spur gears because they mesh together. Gear 'A' is called the 'driver' because this is turned by a motor. As gear 'A' turns it meshes with gear 'B' and it begins to turn as well. Gear 'B' is called the 'driven' gear.

Tap the image for more information and examples

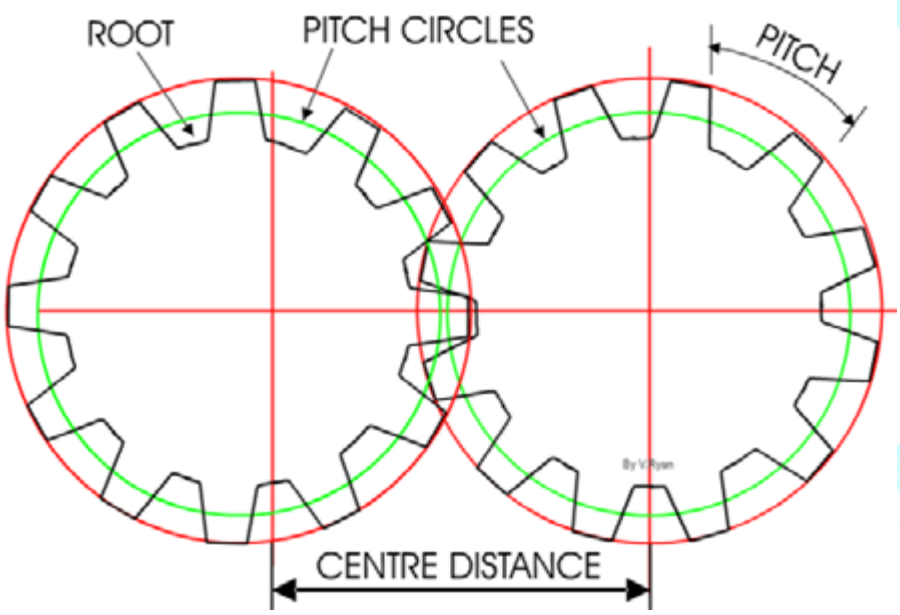


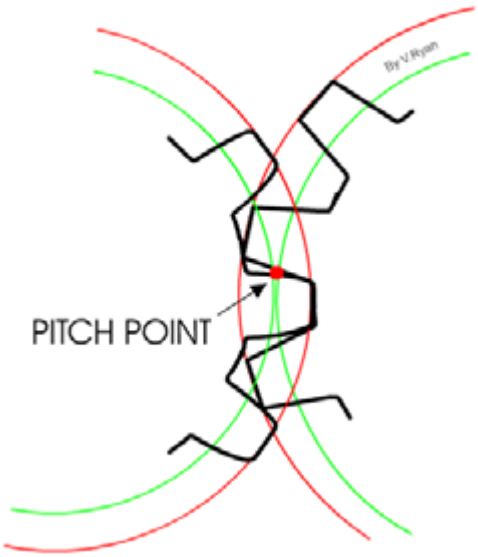
Tap the blue button for the next Gears / Pulley page.

Tap the red button to return to the Contents page

GEAR DETAILS

Tap the image for more information and examples



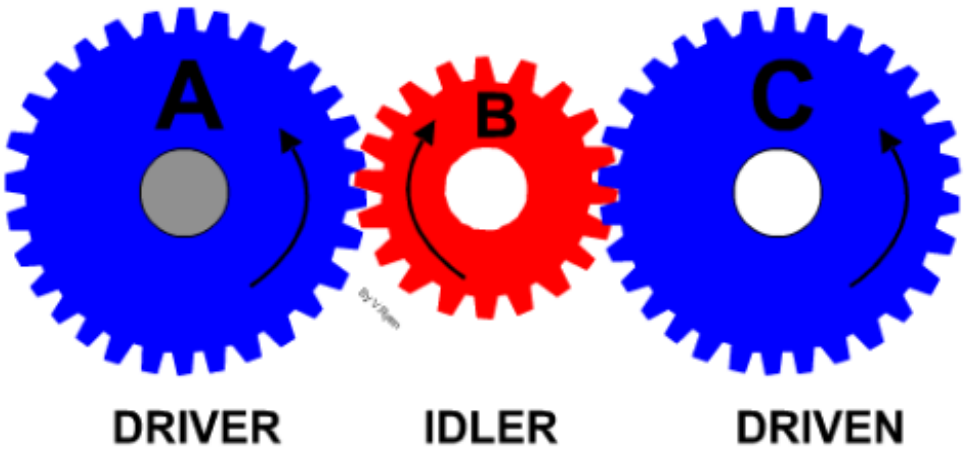


Tap the red button to return to the Contents page

GEAR TRAINS AND IDLERS

So far you have read about ‘driver’ gears, ‘’driven’ gears and gear trains. An ‘idler’ gear is another important gear. In the example below gear ‘A’ turns in an anticlockwise direction and also gear ‘C’ turns in an anticlockwise direction. The ‘idler’ gear is used so that the rotation of the two important gears is the same.
Is the speed of gears A and B the same ?

Tap the image for more information and examples

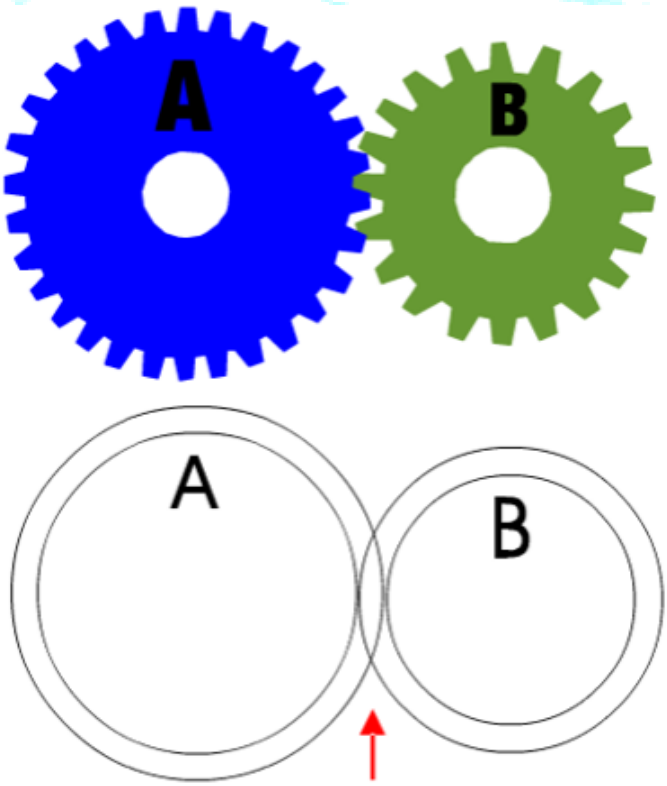


Tap the red button to return to the Contents page

DRAWING GEARS

It would be very difficult to draw gears if you had to draw all the teeth every time you wanted to design a gear system. For this reason a gear can be represented by drawing two circles.

Tap the image for more information

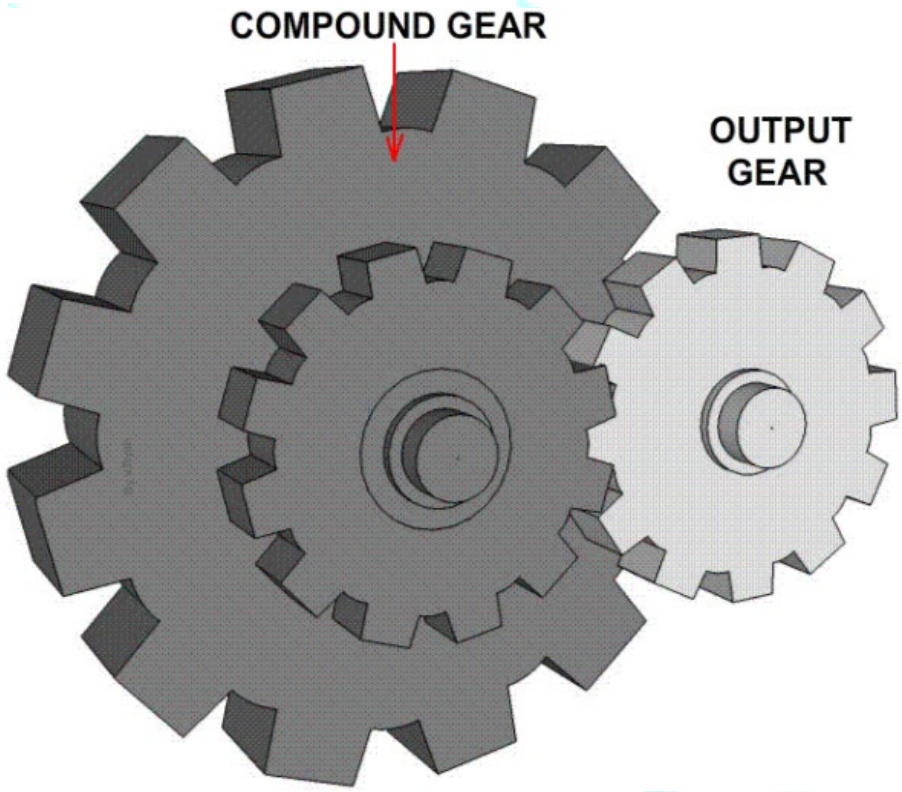


Tap the red button to return to the Contents page

COMPOUND GEARS

A compound gear is a number of gears fixed together. They rotate at the same speed. The gears that make up a compound gear usually differ in size and have a different number of teeth. This is useful if there is a need to speed up or slow down the final output.

Tap the image for more information



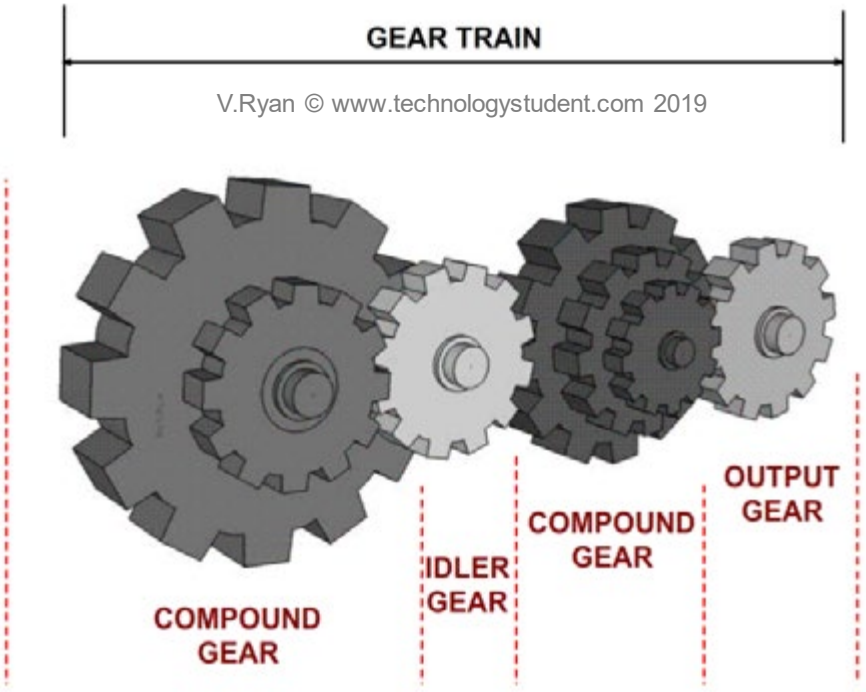
Tap the blue button for the next Gears / Pulley page.

Tap the red button to return to the Contents page

COMPOUND GEARS AND GEAR TRAINS

The gear train below has gear wheels, including two compound gears. Gear trains like this are often found inside machines such as centre lathes and milling machines. On a smaller scale, plastic gear trains are found inside DVD recorders.

Tap the image for more information and examples

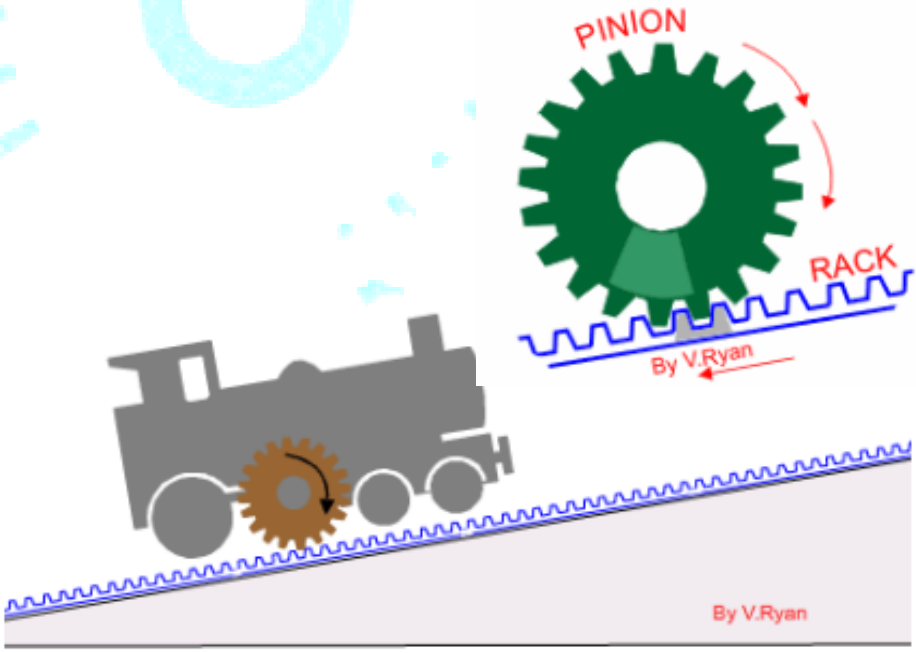


Tap the red button to return to the Contents page

RACK AND PINION GEAR SYSTEMS

A ‘rack and pinion’ gears system looks quite unusual. However, it is still composed of two gears. The ‘pinion’ is the normal round gear and the ‘rack’ is straight or flat. The ‘rack’ has teeth cut in it and they mesh with the teeth of the pinion gear.

Tap the image for more information and examples



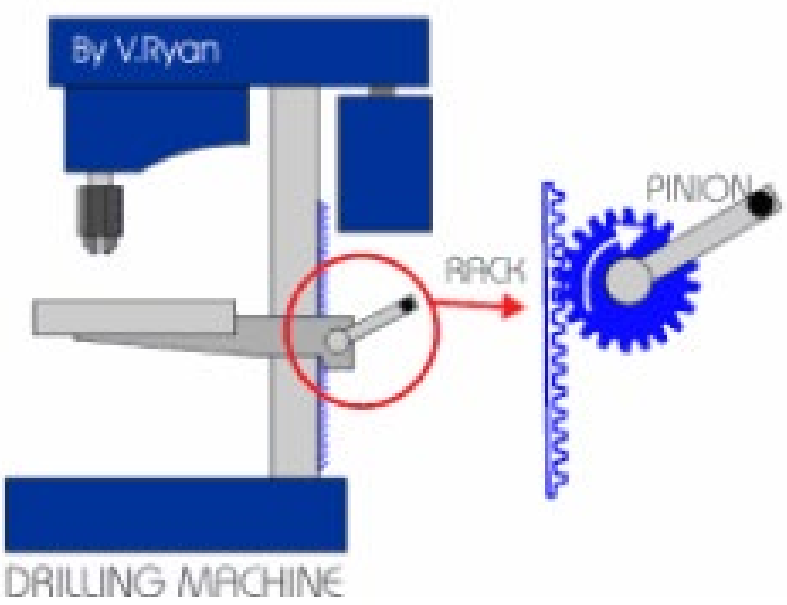
Tap the blue button for the next Gears / Pulley page.

Tap the red button to return to the Contents page

RACK AND PINION - DRILLING MACHINE

An example of a rack and pinion as seen in this drilling machine. As the handle is turned the table moves up and down the central pillar of the drill.

Tap the image for more information and examples

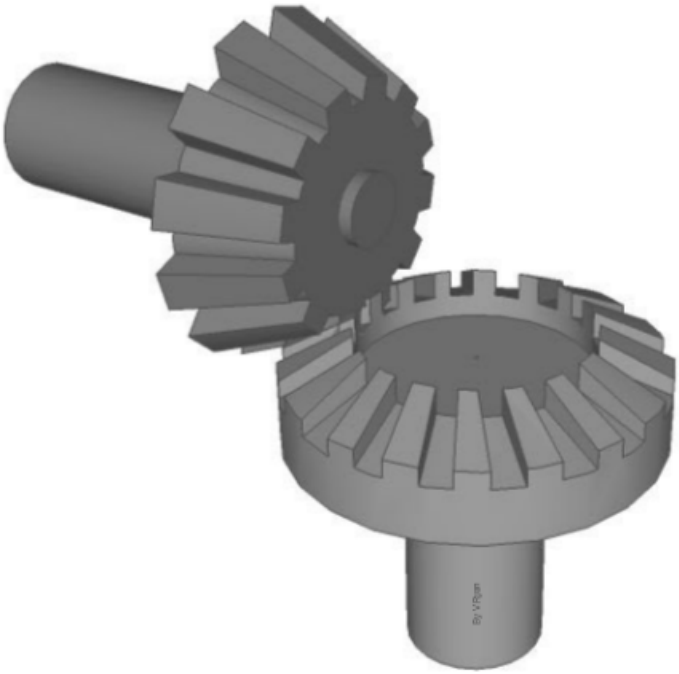


Tap the red button to return to the Contents page

BEVEL GEARS

Bevel gears can be used to change the direction of drive in a gear system by 90 degrees. A good example is seen as the main mechanism for a hand drill. As the handle of the drill is turned in a vertical direction, the bevel gears change the rotation of the chuck to a horizontal rotation.

Tap the image for more information

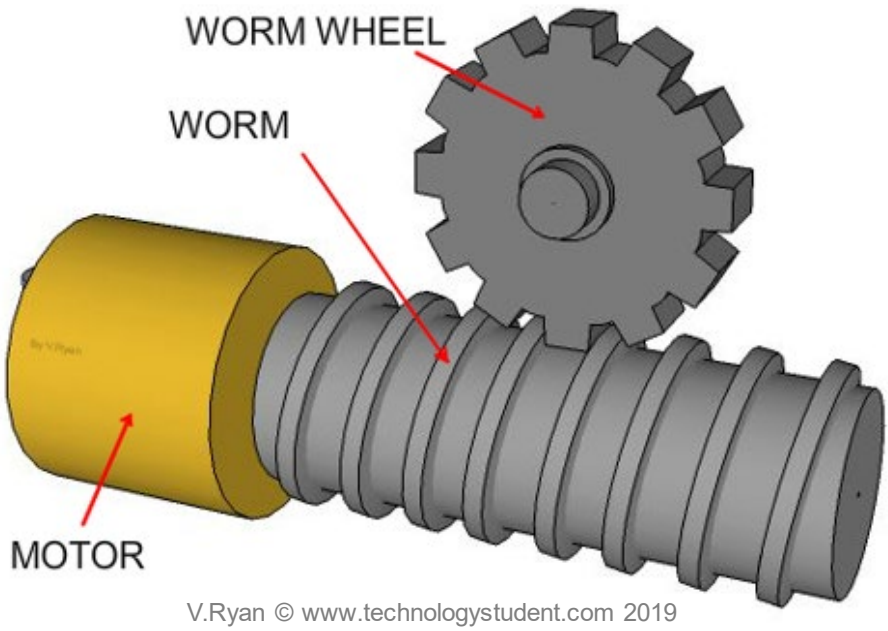


Tap the red button to return to the Contents page

WORM GEARS

The arrangement of gears seen above is called a worm and worm wheel. The worm, which in this example is brown in colour, only has one tooth but it is like a screw thread. The worm wheel, coloured yellow, is like a normal gear wheel or spur gear. The worm always drives the worm wheel round, it is never the opposite way round as the system tends to lock and jam.

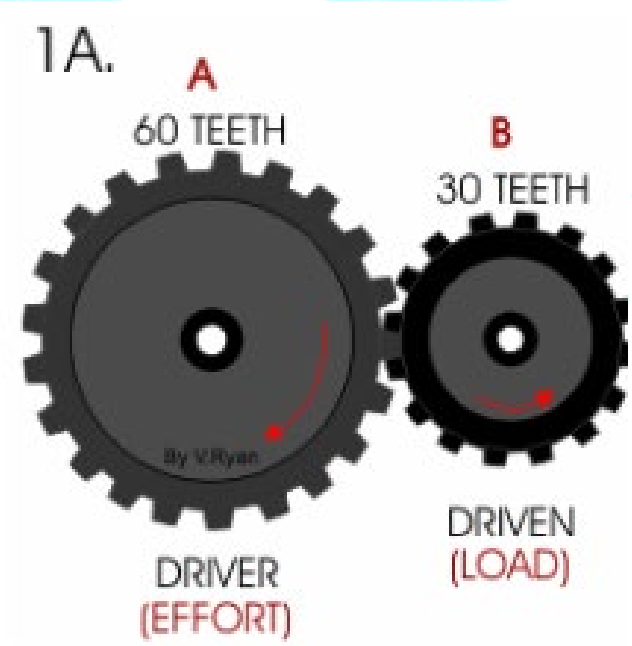
Tap the image for more information



Tap the red button to return to the Contents page

GEARS AND CALCULATIONS

Tap the images for a link to lots of questions and answers – calculations regarding gears



Work out the Velocity Ratio (Gear Ratio);

$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \frac{\text{60T (GEAR A)}}{\text{30T (GEAR B)}}$$

$$= \frac{1}{2} = \frac{\text{Input movement}}{\text{Output movement}}$$

$$= \text{Driver} : \text{Driven}$$

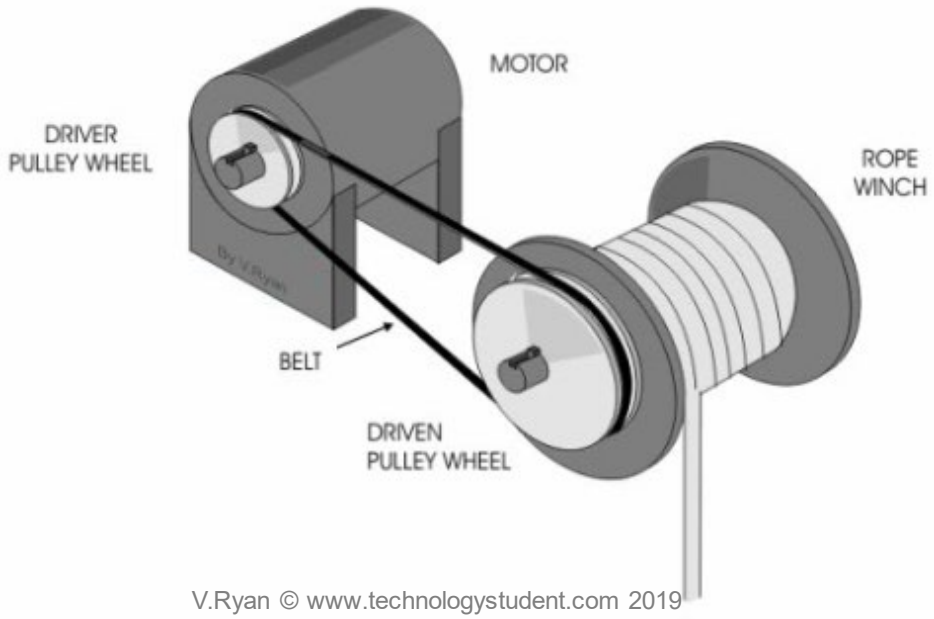
$$1 : 2$$

Tap the red button to return to the Contents page

PULLEY SYSTEMS

Pulley systems transmit rotary motion. Below is a simple mechanical device to winch up and down a rope. When the motor is turned on it revolves the driver pulley wheel. The belt causes the driven pulley wheel to rotate as well, winding out the rope. The small pulley is known as the DRIVER, because it is connected to the motor which provides all the power / drive to the entire pulley system. The larger pulley (DRIVEN pulley) is 'driven' round by the driver pulley wheel.

Tap the image for more information



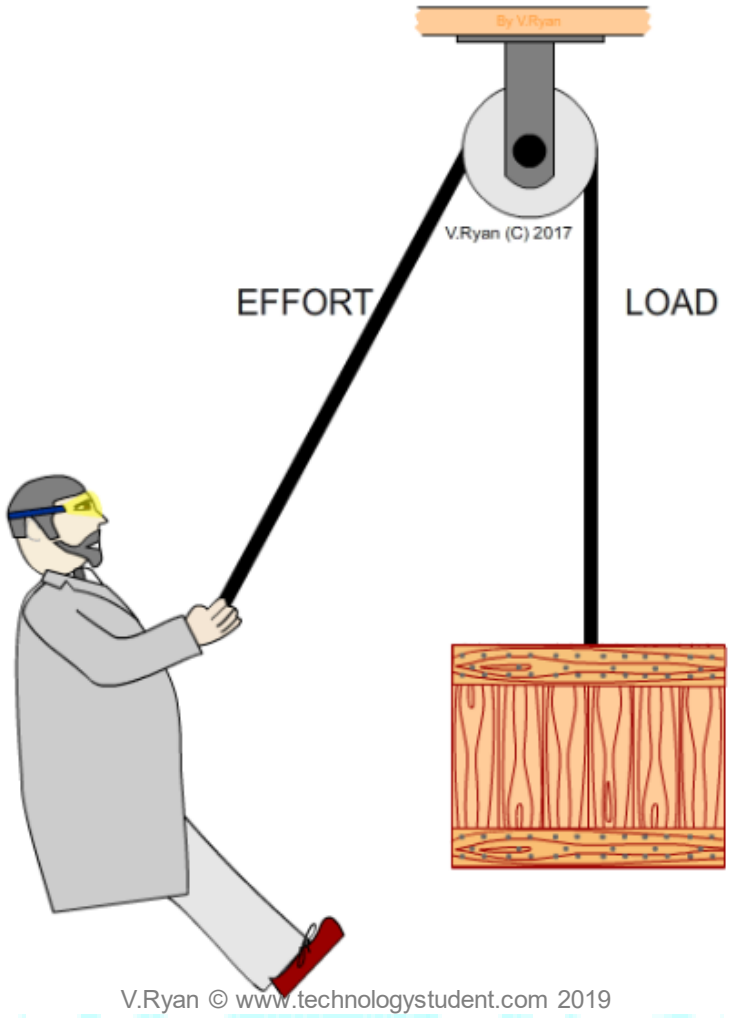
Tap the blue button for the next Gears / Pulley page.

Tap the red button to return to the Contents page

PULLEYS AND LIFTING

Pulley systems can be used to lift weights safely and effectively. The rope is 'pulled' on the effort side and the weight being lifted is on the right hand side, called the 'load'.

Tap the image for more information



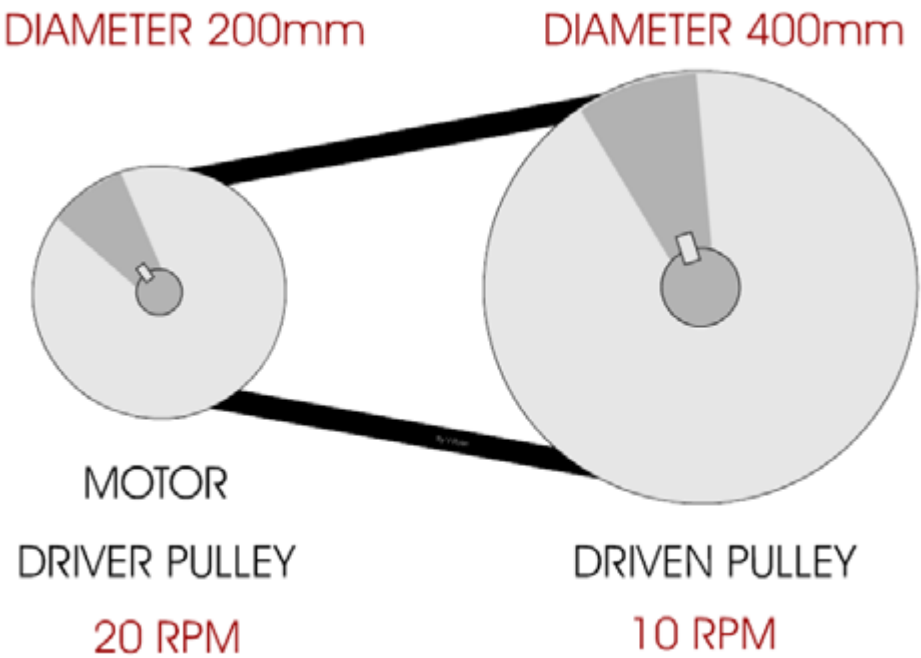
Tap the blue button for the next Gears / Pulley page.

Tap the red button to return to the Contents page

PULLEYS AND BELT DRIVE SYSTEMS

Pulleys are used in combination to speed up and slow down machines. Consequently, this involves calculations, to work out velocity ratio and RPM (revolutions per minute)

Tap the image for more information and example calculations



Tap the blue button for the next Gears / Pulley page.

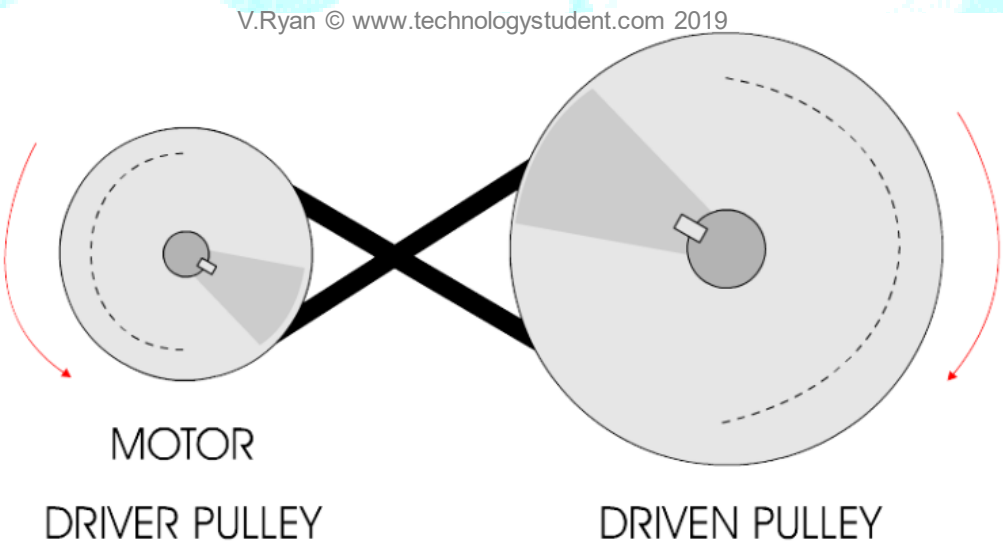
Tap the red button to return to the Contents page

PULLEY SYSTEMS - REVERSING ROTATION

Sometimes it is necessary to reverse the rotation of the driven pulley wheel in relation to the driver pulley. If the driver is rotating in an anti-clockwise direction the driven pulley may be required to rotate in a clockwise direction.

This is achieved by twisting the belt as shown below.

Tap the image for more information

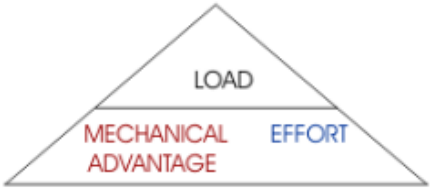


Tap the blue button for the next Gears / Pulley page.

Tap the red button to return to the Contents page

PULLEYS AND LIFTING IMPORTANT FORMULAS

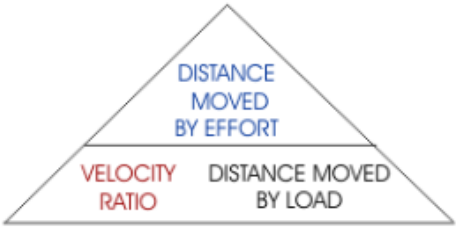
Tap the images for more information, examples, calculations and exam questions on pulley systems



$$\text{MECHANICAL ADVANTAGE} = \frac{\text{LOAD}}{\text{EFFORT}}$$

$$\text{LOAD} = \text{MECHANICAL ADVANTAGE} \times \text{EFFORT}$$

$$\text{EFFORT} = \frac{\text{LOAD}}{\text{MECHANICAL ADVANTAGE}}$$



$$\text{DISTANCE MOVED BY LOAD} = \frac{\text{DISTANCE MOVED BY EFFORT}}{\text{VELOCITY RATIO}}$$

$$\text{VELOCITY RATIO} = \frac{\text{DISTANCE MOVED BY EFFORT}}{\text{DISTANCE MOVED BY LOAD}}$$

$$\text{DISTANCE MOVED BY EFFORT} = \text{DISTANCE MOVED BY LOAD} \times \text{VELOCITY RATIO}$$

Tap the red button to return to the Contents page