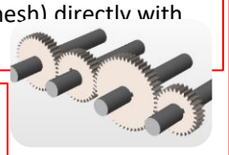
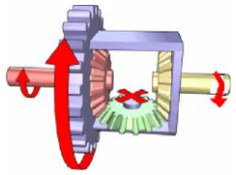
GEARS

A number of gears connected together is called a **"Gear Train"** The gear train is another mechanism for transmitting **rotary motion and torque**. Gears have teeth which interlock (or mesh) directly with one another.

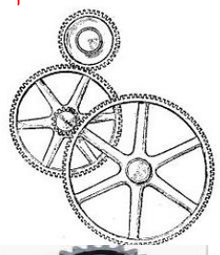


Gear Systems
Gear systems can be used to increase and decrease rotational velocity. Gears are used to increase or decrease the speed or power of rotary motion.

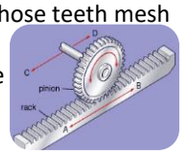


Bevel gears are used to turn a drive through 90°. In the hand drill example shown, bevel gearing also increases the speed of rotation of the chuck. Bevel gears, like worm gears, use shafts at an angle of 90°. The hand drill shown uses them not only to change the rotary motion through 90°, but also, by using different sized gears, to increase the speed of rotation.

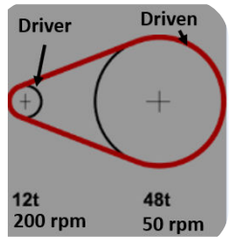
Compound gear systems
Sometimes a simple gear train cannot provide a big enough gear ratio. If a large reduction in speed (or increase) is required then more than one set of gears can be used together. This is referred to as - "**Compound gear trains**".. Compound gear trains involve several pairs of meshing gears. They are used where large speed changes are required or to get different outputs moving at different speeds.



A **rack and pinion** is used to transform **rotary motion into linear motion** and vice versa. The rack and pinion: A rack is a 'flat' gear whose teeth mesh with the teeth of a pinion. If the pinion is rotated, the rack will move 'sideways' in a straight line.

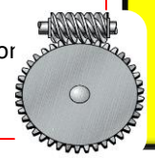


Where there are two gears of different sizes, the smaller gear will rotate faster than the larger gear. The difference between these two speeds is called the **velocity ratio**, or the **gear ratio**, and can be calculated using the number of teeth. The formula is:
Gear Ratio = number of teeth on **driven gear** ÷ number of teeth on the **driver gear**.



So the gear ratio for the simple gear train, if the smaller gear is the driver gear, is:
Gear ratio = 48 ÷ 12= 4.
In other words, the driver gear revolves four times to make the driven gear revolve once.
If you know the gear ratio, and the speed input at the driver gear, you can calculate the speed output at the driven gear using the formula:
Output speed = input speed **÷ gear ratio**
So if the gear ratio is 4 and the driver gear is revolving at 200 rpm then the **output speed = 200 ÷ 4 = 50 rpm**

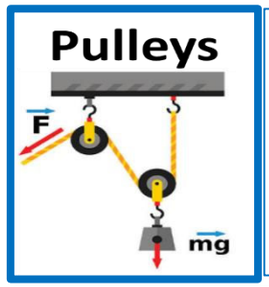
A **worm gear** is a gear consisting of a shaft with a spiral thread that engages with and drives a toothed wheel.. Basically, a worm gear is a screw butted up against what looks like a standard spur gear with slightly angled and curved teeth. It changes the rotation movement by 90 degrees,



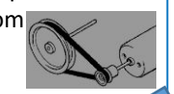
What is Torque?
Torque is a twisting or turning force that tends to cause rotation around an axis, which might be a centre of mass or a fixed point.

-Gears
-Compound gears
-Gear trains
-Rotary motion
-Torque
-Linear motion
-Rack and Pinion
-Bevel Gears
-Worm Gear
-Velocity ratio
-Gear ratio
-Driver Gear
-Driven Gear
-Pulley
-Belt
-Friction
-Tension

Design and Technology



A **pulley** is simply a wheel with a groove in its rim. Using two pulleys and a flexible drive belt rotary motion and torque can be transmitted from one shaft to another.



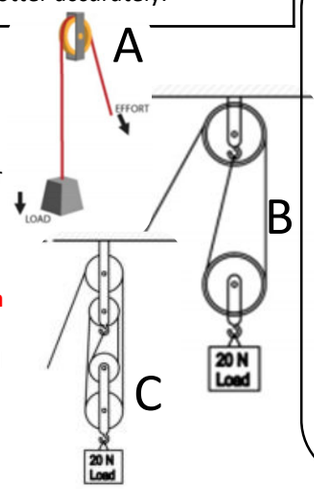
Types of Pulley Belt		
V-Belts. It fits tightly into the groove on the pulley wheels to keep slipping to a minimum	**Round belts** are used where small forces are involved or where the belt has to twist. Round belts are also used on sewing machines and floor cleaners where only small forces are involved.	**Toothed Belts ,**One of the issues with belt drives is that the belts can slip, causing the driven shaft to rotate slower than expected. Too avoid slipping toothed belt can be used. They are used for such things as timing when the valves open and close in a car engine or for moving the pen of a graphic plotter accurately.

Belt Tensioning
Whatever kind of belt is used, it must be tensioned correctly, not too tight and not too slack. If it is too tight, it will apply bending forces to the pulley shafts. If it is too slack it will slip or come off the pulleys. Most systems are tensioned by having the position of one of the pulleys adjustable.

Advantages
The main advantages of belt and pulley transmission systems are that they are: quiet, require no lubrication, and are relatively cheap to produce. They are used in domestic appliances for these reasons. In certain circumstances, slip can actually be useful.

Disadvantages
The main disadvantage is that slip can occur. They should only be used where slip will not affect the operation of the machine. If a pulley system is to be used where slippage would be a problem, special belts can be used.

Pulleys for Lifting
The simplest pulley systems used for lifting a load use only one pulley. This allows the load to be lifted up by pulling down. It is much easier and safer to be on the ground pulling down rather than pulling a load up from above. In theory, to raise the load, your effort force has to be equal to or just greater than the load. There is no mechanical advantage. In practice, with a heavy load, your effort has to be quite a bit more than the load in order to overcome friction. **By using more than one pulley you can create a mechanical advantage**. The more pulleys you use, the greater that advantage is. (Diagram B),shows a pulley system with a mechanical advantage of 2:1. It allows a load to be raised using only **half the effort** needed using a single pulley, **but twice as much rope must be pulled in**. For the second pulley system (Diagram C)with twice as many pulleys the mechanical advantage is 4:1.



-The chances are that you will be expected to work out the velocity ratio, gear ration or mechanical advantage in given mechanical systems.

On these questions make sure you show all of your workings and calculations

Title: Mechanisms (Gears+ Pulleys)

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